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UNC Sea Grant

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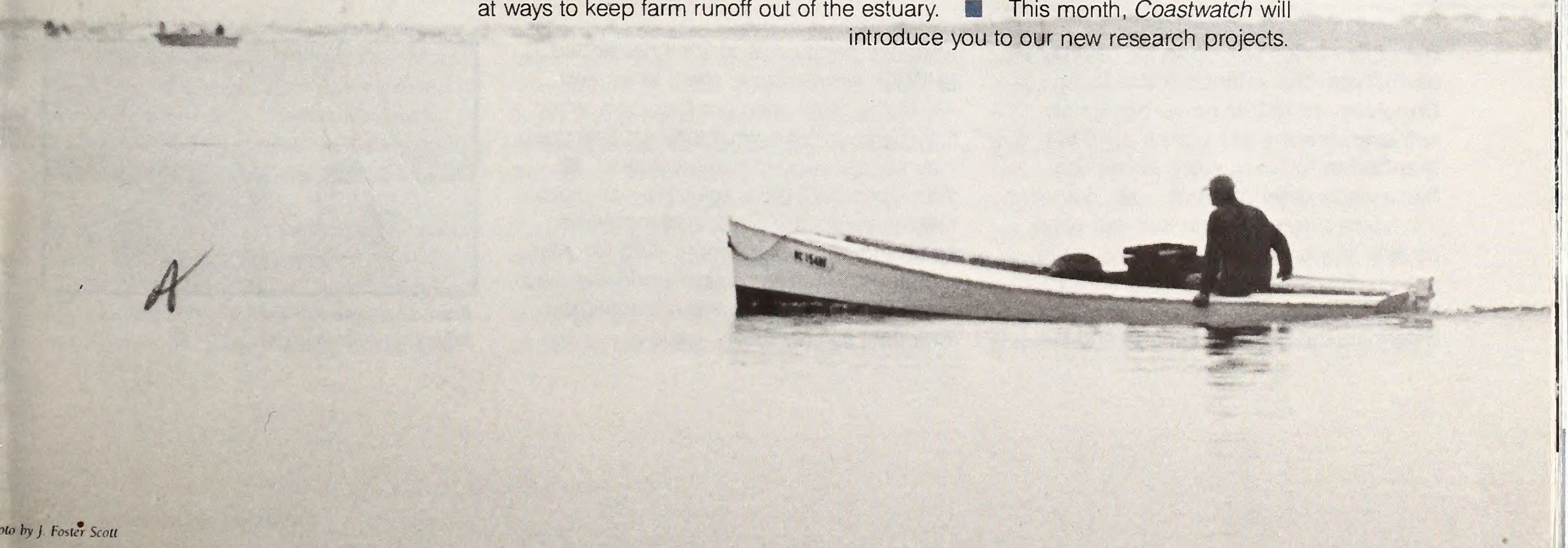
COASTWATCH

A small man-made satellite rocketed into orbit in 1957. With Sputnik, the Soviet Union propelled a lackadaisical America into action. ■ First, there was a push to get a U.S. satellite in space. ■ Then, a young, enthusiastic John F. Kennedy challenged the nation. Not only will we put a man in space, he said, but we will lead the world in scientific discovery. ■ The early 1960s brimmed with optimism. It was a time of new frontiers. One of those was the ocean. ■ Athelstan Spilhaus got caught in the fervor. Dean of the University of Minnesota Institute of Technology, Spilhaus conceived the notion of a program to help the nation tap its ocean resources. ■ His notion became a reality in 1966, when Congress passed a bill creating a national Sea Grant Program. Sea Grant would be a university-based system combining research, extension and education. ■ Under the umbrella of a national office in Washington, programs were developed in every state that fronted the ocean or Great Lakes. There are 31 in all. ■ Using federal and state dollars, the programs tackle the nation's most pressing coastal problems—pollution, development, erosion, seafood utilization and fluctuating fisheries stocks. ■ Sea Grant programs provide grants to university researchers. And they employ extension agents to relay the results to the public. ■ In North Carolina, Sea Grant has been solving marine problems for 17 years. ■ In 1988, we will spend $1.8 million on 25 research projects, 1 education project, a crew of 12 extension agents and a handful of administrators. Nationally, the program is budgeted at $39 million. ■ You may never see the genius of our researchers at work, but their findings will have you eating a better fish stick, catching more crabs and clamming in cleaner waters. ■ At University of North Carolina laboratories, researchers will find new ways to detect harmful viruses in oysters and clams. ■ Near the dunes at Nags Head, coastal engineers will study the effects of erosion. ■ And on farmland in Hyde County, soil scientists will look at ways to keep farm runoff out of the estuary. ■ This month, *Coastwatch* will introduce you to our new research projects.



A

oto by J. Foster Scott

fisheries

If you happen to catch a blue crab wearing a backpack in the Pamlico Sound, don't worry. The crabby crustacean is part of a scientific study, and he's wired for information. ■ In 1986, fishermen harvested over 23 million pounds of hard blue crabs valued at almost $5.5 million. In their soft postmolt state, the crustaceans brought crabbers another $700,000—a seven-fold increase since 1981. ■ The crab harvest dropped from the more abundant 30 million pounds of the early 1980s. And fisheries managers are concerned that development along the coast may affect vital crab habitat. ■ Tom Wolcott, a North Carolina State University zoologist, will examine the blue crab and its habitat. He is one of 12 Sea Grant investigators probing fisheries questions about population fluctuations, disease, pollution and recreational fishing. ■ Wolcott will investigate blue crab hideouts—places where the cranky crustaceans go to molt and mate. He wants to know what kind of habitat crabs prefer during these critical life stages. ■ To monitor the crabs, Wolcott will strap ultrasonic transmitters on their backs and track their paths with receivers and hydrophones. When the crabs molt, they'll leave behind their backpacks and clues to their habitat preferences.

Scallops are a valuable winter fishery; clams a year-round gold mine. ■ In fact, since the price for small hard clams rocketed from two cents apiece in 1975 to an occasional 24 cents apiece in 1987, clammers have plied the waters in record numbers. ■ But there may be trouble ahead. Hard clams are being overharvested, and state resource managers need information to make wise management decisions. ■ To define the problem, researchers must first define the areas clams call home. That is the work of Pete Peterson, a biologist at the University of North Carolina Institute of Marine Sciences. He'll also test a proposed rotation system for harvest areas to see if the mollusks increase in abundance. ■ As for the bay scallop, Peterson plans to learn more about the sweet mollusks' survival rate. Using the results, resource managers can determine whether it's feasible to increase populations by dispersing "seed" scallops in the estuaries.

Photo by Jim Strickland

Pete Peterson will sieve the sound for answers about hard clam and scallop populations

One year, thick schools of spot darken North Carolina coastal waters. The next year catching a spot may be likened to finding the proverbial needle in the haystack. ■ The exact causes for the fluctuations have eluded scientists. But Sea Grant scientists will test some theories. ■ NCSU zoologist John Miller and oceanographer Len Pietrafesa think the answer may lie in the fish's migration path from their spawning grounds to the estuarine nurseries. They believe that the ocean, inlet and estuarine currents play a role in the fish's migration and ultimately their survival. ■ To test their theory, Miller and Pietrafesa will use dye, floats and small plastic particles to simulate the path of fish carried in the currents. And they'll sample the path of fish at different points in their journey. ■ NCSU zoologists Jim Rice and Larry Crowder believe the population fluctuations may be linked to the size of larval fish as they enter the estuary. Their size could well determine how susceptible the fish are to predation and starvation—the most frequent causes of death in baby fish. ■ To test the theory, Rice and Crowder will use field and laboratory experiments to design a computer model that can predict how fish size affects the survival of larvae.

David Checkley will soon be getting an earful from the Atlantic menhaden. Checkley, an NCSU oceanographer, will examine the ear bones of larval menhaden to learn more about the fish's early development. ■ Larval fish add a protein layer to their ear each day the way a tree adds a yearly ring of growth. By using sophisticated equipment to examine the ear bone, Checkley can determine the menhaden's age and the water temperature at which it developed. ■ Water temperatures affect when and where the menhaden are spawned, when they begin to feed, what they eat and how they are transported to the estuary. ■ With Checkley's data, scientists can more readily predict the location of menhaden spawning and development. And fisheries managers will have a better understanding of the habitat needs of this economically important fish (see story, page 5).

Photo by Scott Taylor

Researchers will delve into the mysteries of fishery stock fluctuations

Fishing isn't work for all those who ply the sea. Some folks play at fishing. But don't think for a moment that recreational anglers aren't just as serious about bringing home the catch as their commercial counterparts. ■ David Lindquist, Larry Cahoon and Ileana Clavijo, biologists at UNC-Wilmington, will take a dive to answer important fish feeding questions about artificial and natural offshore reefs—the location of prime fishing spots. ■ Commercial landings of reef fish totaled over $4 million last year. And the reefs attract hundreds of recreational anglers who add dollars to the coastal economy. ■ Since 1986, the state has sunk $500,000 into enhancing or constructing 20 artificial reefs. ■ Lindquist, Cahoon and Clavijo plan to dive on natural and artificial reefs to learn more about the food sources of the fish they attract. The scientists believe that the ocean's soft bottom areas may be as important as the hard reef substrate in providing a fish's next meal. ■ Say a weekend angler wants to fish a particular artificial reef. How does he find out the reef's location? That's what Rick Perdue wants to know. ■ Perdue, a researcher in the NCSU Recreational Resources Department, would like to find out how anglers receive, use and relay information about recreational fishing. ■ Understanding the communications network will help resource managers who need to tell anglers about regulation changes and educate them about alternative species.

If fish could let their fins do the dialing, no doubt they'd call Ed Noga. He's a fish doctor. ■ A scientist at the NCSU School of Veterinary Medicine, Noga studies the bacteria and diseases that afflict our underwater friends. Last year, Noga succeeded in culturing a disease-causing parasite in the laboratory. It was a first. ■ Now, Noga will try to find out what natural factors—temperature, pH, salinity or minerals—will kill the parasite without damaging its fishy host. The information could be useful for pond-raised fish where disease can spell disaster.

Sea Grant research into shellfish contamination may mean safer clams for the table

Oysters and clams carry diseases of a different nature—human bacteria and viruses. ■ As filter feeders, oysters pass eight gallons of water through their systems each hour. And if the water is polluted with harmful bacteria and viruses, the oysters become contaminated, too. ■ In his UNC laboratory, Mark Sobsey will search for new ways to detect harmful human viruses in shellfish and their surrounding habitats. In his past project, Sobsey determined that present bacteria indicators were inadequate. ■ A method is needed to separate human and animal fecal contamination. The result may mean less areas are closed due to contamination and that safer shellfish will reach our tables. ■ In a sister project at UNC-Wilmington, Ron Sizemore will develop a way to track human waste contamination to its source. ■ Every time a human passes waste from his body, he emits billions of bacteria. These bacteria carry extrachromosomal particles called plasmids. These plasmids make one person's bacteria different from another's, and human bacteria different from animal bacteria. ■ By isolating the bacteria and taking water samples, Sizemore may be able to accurately pinpoint sources of pollution.

coastal processes

The dream is an old one, reborn every time ten toes wiggle in the sun-baked sand. The dream is a house so close to the shore that the salt spray wets your lips and the ocean is at your front door. ■ Denis Bailey had the dream. ■ In 1970, the Virginia man and his family built a new home in South Nags Head right on the oceanfront. But the vacation is over. Bailey must move his house. ■ The ocean has come to his front door. ■ Bailey's story is just one of many associated with a severely eroding stretch of shore from Oregon Inlet to Whalebone Junction. In some places, up to 50 feet of beach per year have been chewed up and swallowed by the sea. ■ Normal erosion rates near inlets range from two to 18 feet per year, says Spencer Rogers, Sea Grant's coastal engineer. ■ But this is something different. This area or "feature" of high erosion appears to be moving north from Oregon Inlet at a rate of 800 to 1,000 feet per year. ■ Rogers believes this mobile monster is the result of eight hurricanes and the Ash Wednesday northeaster that widened Oregon Inlet more than 4,500 feet between 1950 and 1963. Afterward, the inlet began to fill in—with sand from the adjacent beach. ■ Aerial photographs document the erosion, but not enough of them have been examined to prove that a feature exists. ■ So Rogers and John Fisher, an NCSU civil engineer, will compare more photographs of the nine-mile stretch. With this, they can identify the erosion feature, its current position and the speed it is moving up the coast. ■ Their results may not help Denis Bailey now, but they can give other property owners and coastal managers a better indication of future shoreline changes near inlets. ■ Coastal managers will have something else to thank Fisher for soon. He and Margery Overton, an NCSU civil engineer, are developing a technique to predict dune erosion during storms. ■ For four years, the team has tested the relationship between wave force and dunes by using a small wave tank at NCSU and test dunes in the field. ■ Now they'll use tanks 300 feet long and 15 feet wide at Oregon State University to refine and validate their theories. ■ Their findings can be used to design dunes for shoreline protection and to evaluate potential flooding due to dune erosion during storms.

Photo by Scott Taylor

Sea Grant researchers will learn more about the forces that caused this erosion at Topsail Beach

estuaries

Photo by Jim Strickland

Sea Grant will focus much of its research on the estuary—the ocean's nursery

The Albemarle-Pamlico Sound system is the second largest estuary in the nation, stretching from Currituck to Carteret counties. It accommodates numerous finfish and shellfish nursery areas and supports diverse commercial and sportfishing industries. ■ That adds up to at least $130 million for the state each year. ■ But this valuable estuary is threatened. ■ Burgeoning populations in nearby counties add new pressures to water use. More sediments and nutrients like nitrogen and phosphorus find their way down the rivers into the sounds. ■ The results range from declines in some fisheries to nuisance algal blooms that surface in the summer. ■ Water quality managers are worried. They need more data on the current status of the sound system to find ways to protect it for future use. ■ Sea Grant researchers are hoping to fill the void. ■ Biologist Hans Paerl and physicist Richard Leuttich with the University of North Carolina Institute of Marine Sciences plan to develop a new way to estimate the productivity of the estuary. They'll look at how much food is produced by algae, the first link in the estuary's food chain. Knowing this will tell them how much food is available to other plants and animals. ■ Paerl and Leuttich will also examine the feeding activities of zooplankton, the next link in the chain. ■ To get the most accurate results, the team will sample the water at various points in Pamlico Sound. Then they'll simulate the water's turbid conditions by spinning the samples in a horizontal wheel and exposing them to different amounts of light. ■ Using this approach, the team can tell how the food chain varies seasonally and under different environmental conditions. ■ Researchers know that nutrients behave as fertilizers on algae just as they do on lawns and crops. They spur growth. ■ An extra dose of nitrogen or phosphorus can be good for corn, but in the estuary it causes problems—massive mats of nasty blue-green algae. And the flow of nutrients from sewage treatment plants, farms, forests and industries seems endless. ■ But so far, scientists don't know how many nutrients are too many nutrients. So biologists Don Stanley and Joseph Boyer of East Carolina University will experiment on a smaller scale. ■ They'll inject differing amounts of nitrogen and phosphorus into huge tanks of water that resemble mini-estuaries. Then they'll record what types of algae occur and how fast they grow. ■ Stanley and Boyer also will use the tanks, which are located at the University of Rhode Island's Marine Ecosystems Research Laboratory, to look at how plants, animals and fertilizers recycle certain nutrients. ■ Their results may help water quality managers regulate the supply of nutrients seeping into the estuaries. ■ Two other Sea Grant researchers believe there may be a link between nutrients and the seagrass that grows in the estuary. ■ Where seagrass habitats along the East Coast have declined, so have important fisheries. Botanist Joanne Burkholder and zoologist Larry Crowder of North Carolina State University want to study how environmental factors and animals affect seagrass. ■ Using the tanks in Rhode Island, Burkholder will determine whether nutrients enhance seagrass growth or diminish it. Some nutrients may cause an overabundance of algae that would shade the beds and keep the grasses from producing food. The team thinks that animals further up the food chain also may affect seagrass growth. Crowder will use snails, fish, crabs and other grazers to see if they eat the algae or the grass. ■ Controlling nutrients at their sources—chiefly farms, wastewater treatment plants and industries—is one way to inhibit algal growth. ■ But to farm the wet soils of the coastal plain, growers must drain water from their fields. The fertilizer-laden runoff seeps into the estuaries. ■ Research has shown that good farm management practices reduce the loss of nitrogen from fields by as much as 50 percent. ■ But NCSU researchers Charles Reynolds, Wendell Gilliam and Wayne Skaggs want to predict with more certainty how management practices affect the movement of nutrients from the fields to nearby waters. ■ The team will compare fields with conventional drainage, controlled drainage and subirrigation. Then they'll monitor drainage from the test fields for nutrient levels. ■ This information will help them develop a model to predict the movement of nutrients to surrounding waters. ■ Once in the water, nutrients do more than just float downstream. They often become attached to sediments that also move downstream. When the biochemical conditions are right, the nutrients are released. ■ All of this movement leaves resource managers wondering just how many nutrients are in the system, where are they going and how they affect estuarine productivity. ■ Using lab and field experiments, East Carolina University scientists William Rizzo and Robert Christian plan to find out. The team will determine the role of sediments in removing or retaining nutrients in the state's rivers and estuaries. ■ Researchers John Wells and Larry Benninger of UNC-Chapel Hill have a another type of sediment in mind. They will examine large particles of silt and clay called "marine snow" that collect toxins from the water. ■ They'll photograph the underwater snow as it falls in the Neuse River to get an accurate picture of the shape, settling speed and alteration of these microscopic particles. ■ The team also wants to find out where the sediments go, at what rates, and how long they stay in the storage sites where they are deposited. ■ All of these projects aimed at establishing better water quality will have one big benefit—an increase in recreation and tourism in coastal North Carolina. ■ NCSU economists Kerry Smith and Raymond Palmquist want to know what North Carolina estuaries are worth in terms of recreational fishing and how their quality affects people's decisions to use them. ■ To find out, the researchers will analyze three economic models. Then they'll come up with a method for assessing the impact of management decisions on demand for recreation.

Photo by Scott Taylor

Wayne Skaggs and Wendell Gilliam will find ways to keep runoff on the farm and out of the estuary

aquaculture

Photo by Neil Caudle

This juvenile hybrid striped bass may be the foundation for the state's next major aquaculture industry

American appetites for seafood are getting bigger every year. To satisfy our hunger, we import half the seafood we eat. ■ There's simply too much demand and not enough supply. ■ Aquaculture, or fish farming, alleviates some of these problems. It provides a consistent quality and steady supply. ■ North Carolina already has a flourishing aquaculture industry. Last year, the state was the second largest producer of rainbow trout in the nation. ■ But Sea Grant research over the last 10 years has produced another candidate for aquaculture—the hybrid striped bass. ■ The hybrid is a cross between a striped bass and a white bass, and Sea Grant researchers have proven the fish can be farm-raised in ponds. Ron Hodson, associate Sea Grant director, thinks the hybrid will surpass the rainbow trout as the state's number-one cultured seafood. ■ Now the fish is receiving its first commercial test. In Beaufort County, farmer Lee Brothers is raising a hybrid crop. If he succeeds, the state will have the birth of a new industry. ■ Meantime, Sea Grant's aquaculture team—Hodson, nutritionist Margie Gallagher and economist Jim Easley—will perfect the science of raising the hybrid. ■ Hodson would like to reduce the time it takes to produce a marketable fish. Now it takes about two years to get a 1 1/2-pound fish. ■ In a joint project with Maryland Sea Grant, Hodson will try to shorten that to one season by treating fish with a growth hormone. Fish already have growth hormones in their bodies. But increasing the amount may spur the fish to grow faster. ■ Hodson will determine how much hormone to apply and when in the fish's life cycle to apply it. ■ Like all creatures, fish need the right amounts of proteins and vitamins. Commercial feeds may not provide all of that. ■ In her ECU laboratory, Margie Gallagher learned that a healthy harvest of fish depends on the quality of the fish's diet as larvae. So she'll focus her work on the fish's first meals. ■ If Lee Brothers is as successful in his venture as Hodson believes, he'll sell his first crop of fish next year. But the market for hybrids is a new one, and it may offer some surprises. ■ NCSU economist Jim Easley would like to eliminate some of the uncertainty that goes along with a new industry. ■ He'll help fish farmers decide how much they should invest in their venture, what the costs will be, and when will be the best time to put their product on the market.

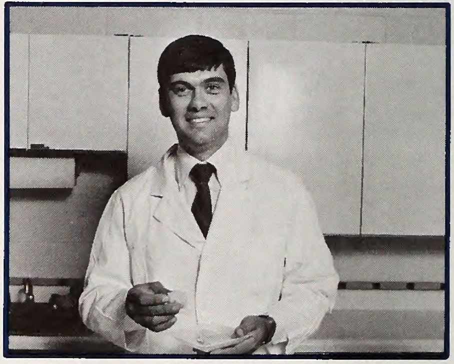
Photo by Nancy Davis

Ron Hodson prepares hybrid striped bass eggs for incubation

seafood

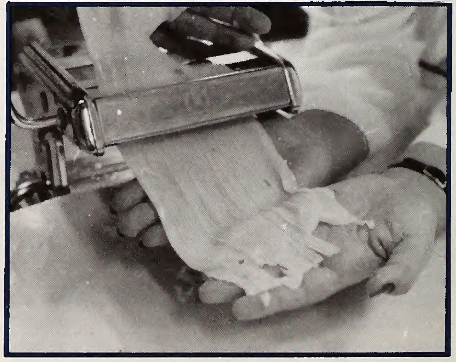
Two ECU anthropologists have an unusual assignment ahead of them. For the next two years, they will examine the minds of America's seafood consumers. ■ David Griffith and Jeff Johnson want to find out what folks know about seafood, what motivates them to buy it, and how they perceive seafoods versus other meats. ■ For answers, Griffith and Johnson will survey more than 1,000 people from Midwestern and South Atlantic states. ■ On the top of their list of questions is whether consumers have tried any of the surimi-based products on the market now. ■ Developed by the Japanese, surimi is fish paste that is molded into imitation seafood products such as shrimp, scallops and crab legs. Surimi seafoods are the fastest growing seafood products on the market. ■ But even so, their potential market may be limited. Consumers usually learn about seafood in restaurants. But many restaurants don't plan to serve surimi-based seafoods. ■ When Griffith and Johnson complete their survey, the surimi industry can use the information to teach consumers about their products. And the researchers will work with Sea Grant's Marine Advisory Service Director Jim Murray to develop an educational program to increase seafood consumption. ■ Eventually, consumer acceptance of surimi may help menhaden fishermen. Until now, menhaden has been ground into fertilizer or chicken feed, but it's never been served on the dinner table. ■ NCSU food scientist Tyre Lanier has perfected a method for making menhaden surimi. And a National Marine Fisheries Service pilot plant has been set up to make surimi products commercially. ■ Lanier has great expectations for surimi. Along with NCSU food scientist Donald Hamann, he will determine whether surimi could be a useful additive in other foods. ■ As surimi-based foods become popular, they create another problem—what to do with the waste the process generates. ■ Only about 20 percent of the fish is actually used for surimi. The remainder is discarded or used for chicken feed. ■ Along with Sea Grant seafood specialist David Green, Lanier will search for ways to turn surimi wastes into useful food additives.

Photo by Allen Weiss



Tyre Lanier tastes the results of his research efforts with surimi

Photo by Cassie Griffin



Surimi is prepared for use in imitation crab legs

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

More than 1,000 people came to the coast Sept. 19, but they didn't collect shells or reel in blues. They went fishing for trash as part of Beach Sweep '87.

The event brought people together from across the state to clean up the coast from Corolla to Calabash. In all, they collected more than 14 tons of debris.

Nature groups, science clubs, Girl Scout troups and other volunteers reported finding everything from plastic straws to a contact lens.

And for the first time in North Carolina, cleanup workers recorded each item found. The survey will be used to pinpoint waste sources and target further cleanup and education efforts.

One tally card included 393 plastic bags, 11 shoes, 51 toys, 357 Styrofoam cups and 370 metal drink cans. Other items found were 17 wads of fishing line, 18 disposable lighters and more than a dozen egg cartons.

Such litter poses danger for birds and other marine life. Heightened awareness of this problem means a cleaner beach and a safer place for people and animals.

That was the purpose of Beach Sweep, which was organized by UNC Sea Grant, the N.C. Division of Parks and Recreation, the N.C. Division of Coastal Management and the Office of Marine Affairs.

"People had a good time cleaning up their environment," says Andy Wood, an educator at the N.C. Aquarium at Fort Fisher and an area coordinator for Beach Sweep. "It looked to me like they really cared."

Plans are already being made for next year's cleanup. If you or your organization would like to help, write Lundie Spence at Sea Grant, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605.

In the April issue of *Coastwatch*, you read about Lena Ritter, an Onslow County fisherman, and her five-year struggle to save Permuda Island from development.

Ritter's work finally paid off in September when Gov. Jim Martin formally accepted the island as a part of the state's Estuarine Sanctuary System.

Permuda Island is a slender strip of land nestled in Stump Sound between Topsail Island and mainland Onslow County. Ritter had argued that development would endanger the productive shellfishing grounds around the island.

The island was turned over to the state Division of Coastal Management and will remain in its natural state. As part of the Estuarine Sanctuary System, the island will be used primarily for research and education.

The N.C. Division of Coastal Management recently beefed up the requirements for marinas to obtain operating permits. Many of the changes target pumpout facilities needed to empty sewage from boat holding tanks.

Commercial pumpout systems are available. But they can cost from $3,000 to $5,000.

There is an alternative.

A low-cost portable transfer tank can be made that eliminates the need for lengthy hoses and sewer lines at marinas.

It can be built in an afternoon and for about $250 with a copy of the Sea Grant Blueprint *A Portable Transfer Tank for Boat Waste.*

All it takes is a 30-gallon garbage can, a hand truck, a pump and some hoses. It can be rolled to the dock for pumping wastes from boat holding tanks. Then the tank is rolled back to a sewer connection on land and emptied into the marina's existing waste treatment system.

The Blueprint gives instructions for making the tank and lists other options marinas might use for waste disposal.

For a free copy, write Sea Grant and ask for UNC-SG-BP-82-1.

For years commercial fishermen have considered the cownose ray an enemy. They claimed the ray's healthy appetite was reducing their winter catch of bay scallops and subsequently the profits from the fishery.

The rays, fishermen said, were using North Carolina sounds as a roadside cafe on their fall migration south.

Fishermen asked the N.C. Marine Fisheries Commission to open the sounds to scalloping prior to the cownose migration.

But to see what kind of threat the rays really posed, Sea Grant researcher Pete Peterson set up some experiments.

He built a large corral in the sound and used monafilament line to lightly tether harvestable scallops in seagrass beds and along sandy bottom in the corral. The line kept the tides from rolling the scallops out of the enclosure.

Finally, Peterson let seven rays loose in the corral.

After one day, the rays behaved normally, feeding along the bottom. But not once during the seven-day experiment did the rays eat a single scallop.

To back up this experiment, Peterson also sampled areas where fishermen said the rays were dining on the scallops. He gathered samples three times during the fall.

In none of the areas did the abundance of legally harvestable scallops decline.

Peterson says his experiments prove the ray's reputation is unfounded and that the sounds could remain closed to scalloping until the mollusks reach a more marketable size in the winter.

Continued on next page

Thanks to those of you who contributed to ***Coastwatch.*** Your dollars will help us in our drive to keep the newsletter arriving in your mailbox on a regular basis. We sincerely appreciate your contributions and compliments.

If you'd still like to contribute, send your check to UNC Sea Grant. Make checks payable to North Carolina State University.

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Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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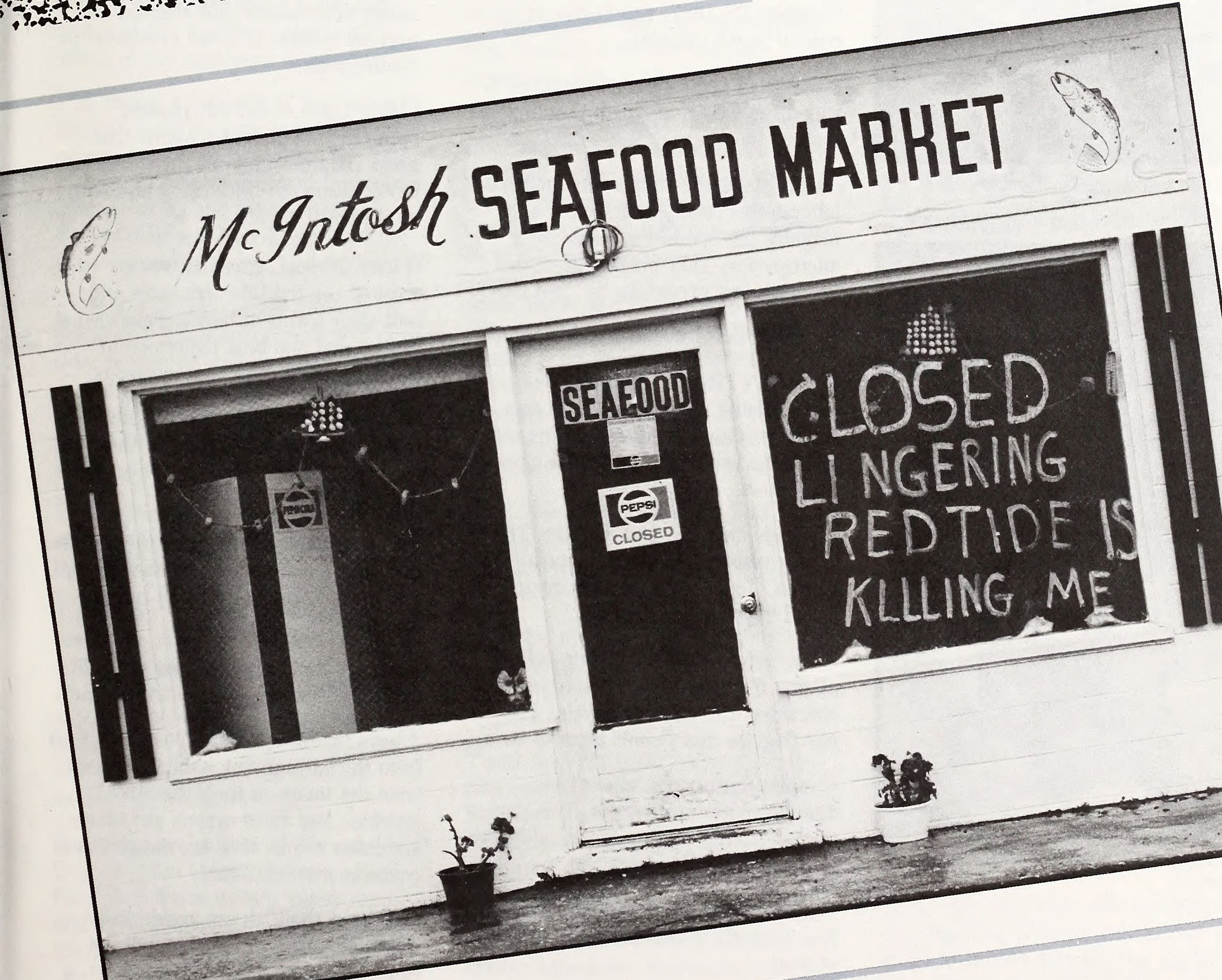
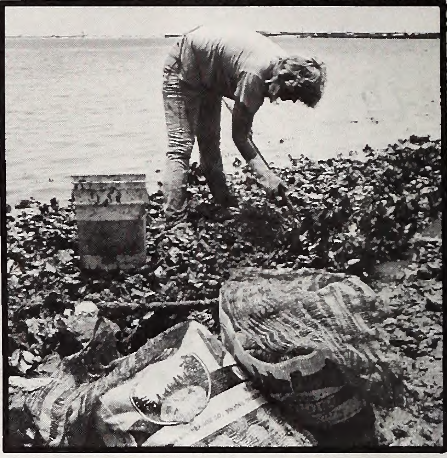


Photo by Scott Taylor

RED TIDE

Invasion of the Red Tide

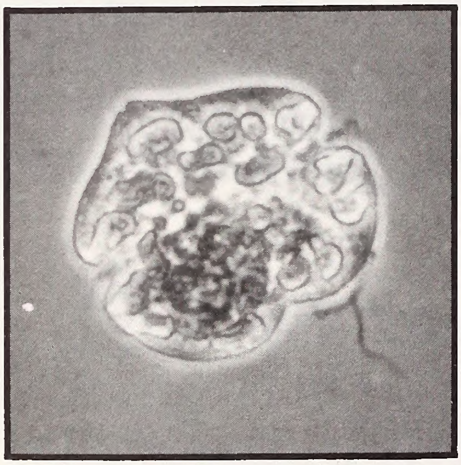
By Kathy Hart



The toxic tide put clammers like these out of business

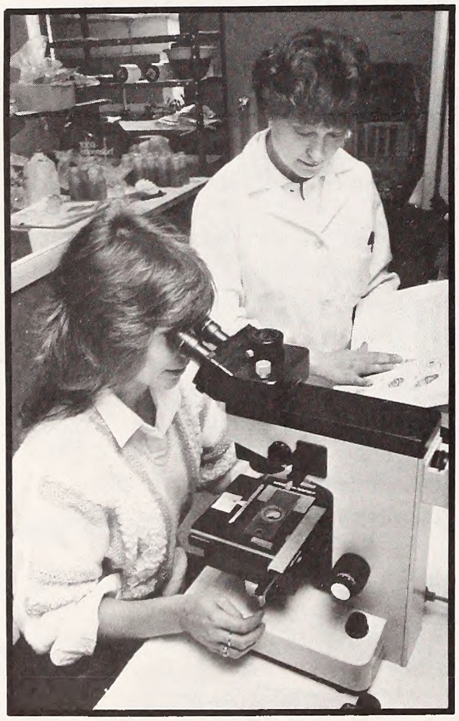
Photo by Scott Taylor

Photo by Jefferson T. Turner



Red tide dinoflagellate, a single-celled organism

Photo by Scott Taylor



Pat Tester, right, helps identify red tide organism

October 31, 1987, was D-Day in coastal North Carolina.

Patches of yellow-green organisms invaded the waters of North Carolina's coast.

Scientists at the state's three marine laboratories scurried to sample and magnify the organisms under their microscopes. They quickly identified the intruding organisms as "red tide."

Red tide in North Carolina?

This isn't Florida, Texas or Long Island Sound where red tide is common. Besides, there was nothing red about the yellowish slicks that clouded the waters.

But the prognosis proved right. The tiny organisms were a subtropical species of a red tide dinoflagellate called **Ptychodiscus brevis.**

More simply, they are single-celled plants. But they have a few animal characteristics such as the tiny hair-like flagella that permit them to swim.

Despite their name, all red tide dinoflagellates are not red. This particular tide was yellow-green, although some patches were brick red.

And it left beachcombers coughing, fish suffocating and shellfishermen out of work.

What could be in organisms 20 microns (a micron is one thousandth of a millimeter) big that could do such damage?

Neurotoxins. This dinoflagellate contained neurotoxins that affected the nervous systems of other creatures, including man.

Other types of red tide possess paralytic and diarrheic toxins that cause paralysis and diarrhea, respectively. Some red tides carry no toxins at all.

Along the surf, crashing waves crushed the red tide organisms and sent their toxins airborne. That's what caused surf and boat fishermen to cough and feel dizzy and nauseous.

The toxins can paralyze the gills of fish, making it impossible for them to pass water over their gills. They soon suffocate.

But the toxins do not taint their flesh. It is safe to eat fish, crabs and shrimp taken from North Carolina's red tide waters.

Oysters, clams and scallops are a different matter.

These shellfish, which filter their food from the surrounding habitat, concentrate the toxins in their digestive systems. And since oysters and clams are eaten whole, they are dangerous to consume even if cooked.

If tainted shellfish are accidentally eaten, this type of red tide will not cause death, says Dan Kamykowski, a red tide expert at North Carolina State University. But Kamykowski says that red tides found along the Canadian and Central American coasts can be deadly.

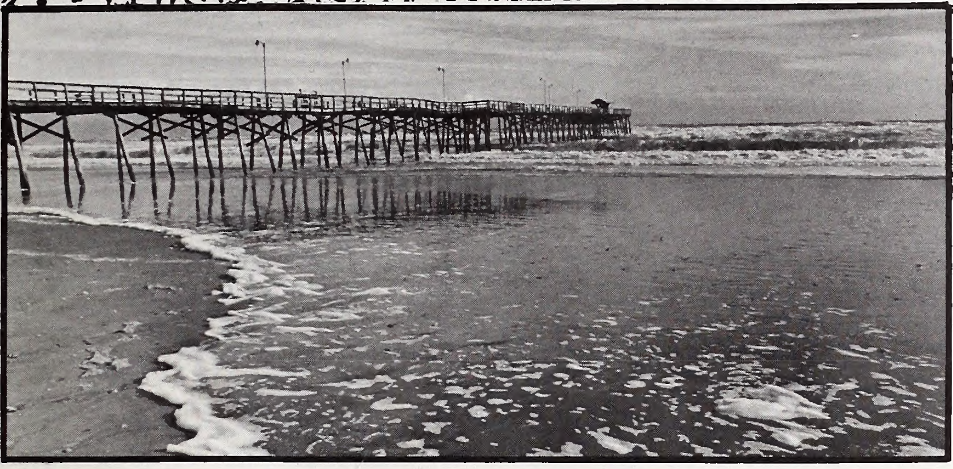


Photo by Scott Taylor

Crashing waves released toxins in the air that sent beachcombers back into their cottages

To eliminate any threat to the public's health, the N.C. Division of Shellfish Sanitation recommended that the N.C. Division of Marine Fisheries ban the harvest of shellfish along a 200-mile stretch of the Tar Heel coast until counts of the organisms dropped.

Pat Tester, a biologist at the National Marine Fisheries Service in Beaufort, says counts of the organisms ran as high as 20 million per liter. Immediate offshore areas and inlets—Beaufort, Bogue, Bear and New River—had the most organisms.

Counts must drop below 5,000 cells per liter before state officials will consider reopening waters. After the counts drop, officials must wait a few weeks to reopen waters so that shellfish can purge themselves of the toxin.

In mid-December, seven miles of water were reopened between Avon and Brooks Point.

But Tester says counts in the Beaufort area were still high in December—100,000 organisms per liter. By the first of January, counts had dropped below 50,000 organisms per liter in most areas, and scientists hoped the new year's surge of cold weather would end the tide's visit.

Scientists are baffled by the red tide's long stay. Sea Grant researcher Hans Paerl says warm waters, sunny days and light onshore winds have caused the tide to linger.

And those conditions may have contributed to the tide's initial onslaught. But there are differing opinions among scientists about just why the Tar Heel coast was invaded.

Tester believes the tide hitched a ride on the northbound Gulf Stream. She points to red tide breakout in Naples, Fla., on Aug. 24.

''We believe that the Gulf Stream was 'seeded' with the red tide organisms then,'' she says.

Forty-eight days later the tide was encroaching on North Carolina's coastline. Tester says that the travel time between Naples and North Carolina in the Gulf Stream would be 40 to 60 days.

Both Tester and Paerl also point to the unique configuration of the Gulf Stream prior to the red tide's appearance. Satellite infrared photographs revealed that an eddy of the warm-water current veered directly into Cape Lookout.

The close proximity of the Gulf Stream plus a gentle onshore wind may have pushed the red tide ashore, scientists say.

And the winds also may have caused localized upwellings of natural ocean nutrients that feed the red tide organisms, Paerl says.

Paerl does not believe that this red tide outbreak was linked to pollution. But Kamykowski says other outbreaks of different red tide organisms may be connected to pollution problems.

Paerl says the red tide not only hitched a ride. It brought a friend—a marine blue-green algae also typically found in subtropical waters.

In fact, Paerl says the slicks of nontoxic blue-green algae were often mistaken for red tide. And its appearance supports the theory that the red tide was an ''imported'' organism.

But Kamykowski says there are at least two other reasons why the red tide may have occurred.

The organisms could have already been present in offshore sediments in a seedlike cyst form. The cysts were possibly planted during a previous red tide that either no one noticed or no one identified, he says.

The wind, wave and weather conditions this fall may have simply jolted the cysts into growth.

Or it is possible, Kamykowski says, that the species is a ''natural part of our marine community''—one that has gone undetected.

But whatever the cause, the main questions on the minds of shellfishermen and beachcombers are how long will the tide stay and will it come back?

Scientists simply don't know the answers. Kamykowski says that very little is known about the life history of this organism.

But state officials are hoping that a new study will find some answers. The Albemarle-Pamlico Estuarine Study Technical Committee approved a $25,000 federal-state grant to study whether the tide is likely to return.

The study will determine whether the dinoflagellate is forming cysts that are likely to survive through the winter. If the cysts survive, they could threaten the state's waters again next year.

But shellfishermen hope that's not the case. They've had enough of the tide called red.

Photo by Scott Taylor

By Sarah Friday

Down and Out in Coastal North Carolina

Twenty-seven dollars a day isn't much, but oysterman Phillip Dixon of Mill Creek figures he's lucky to make that much.

He knows fishermen who haven't seen work in weeks.

Red tide took their jobs.

Now Dixon must drive 60 miles to put in his 17½-foot workboat. Then it takes another hour and a half on the water to reach the oyster beds.

Some days his harvest is good—as much as seven bushels. Others, it is hardly worth the drive to the dock.

Riding out the ebbs and flows of the red tide has been rough for 9,000 of the state's shellfishermen.

The slick muck of algae that spread across the waters of Carteret, Onslow, Pender and New Hanover counties during fall and early winter stymied the oyster, scallop, finfish and clam fisheries.

The toxic tide led to a ban on shellfish harvesting in the 200-mile stretch from Avon to Long Beach. And it scared the public from eating favored fish.

The N.C. Division of Emergency Management gauges red tide cost the state more than $4 million in regard to commercial fishing.

It quelled the recreational fishing industry, too. In the four-county area, pier owners lost from $4,000 to $12,000 per week. Bait and tackle shops showed declines of $500 to $3,000 per week. And charter boat services, $14,000 per week.

The timing of red tide couldn't have been worse.

The 1987 brown and pink shrimp seasons left most commercial fishermen empty-handed. The poor fishing led many to put their hopes in the winter shellfish harvests.

And things looked good.

Prices were up for North Carolina oysters, clams and scallops because harvests in Maryland and Virginia were small.

''We were looking forward to a big season this year,'' Dixon says. ''We had the biggest setting (crop) of oysters in eight years.''

Before the tide, oystermen were pulling 10 to 12 bushels out of the water a day. Now that's been cut in half.

The scallop harvest looked good, too. ''There were scallops like you'd never seen,'' Dixon says.

But red tide hurt that fishery, too. More than 50 percent of this year's bay scallops died, says Sea Grant researcher Charles Peterson, a shellfish expert. And many of the juvenile scallops—next year's harvest—died also.

Most commercial fishermen count on shellfish for an extra $2,000 to $3,000 before Christmas, says fisherman Mark Hooper of Smyrna.

This December, it wasn't there.

On top of that, some fishermen risk losing houses and boats because of missed mortgage payments. Phones have been cut off, meals skipped and furnaces left cold.

''There's people down here that's real hurt,'' says Pinky Lewis, a fisherman for more than 40 years from Beaufort. ''Every day that it goes on, they're that much closer to going out.''

Red tide hit the small operations, the individual fishermen, the hardest. If they couldn't fish, they tried to find construction work or other kinds of jobs. Or they worked on their boats and hoped things would get better.

But for some, fishing is all they know. So they went out of their way to find open waters with untainted shellfish. Or they switched to another fishery.

By mid-November, clammers around Beaufort started sink netting, gill netting and crabbing. Oystermen and clammers farther south began gill netting for spot, speckled trout and puppy drum.

Other fishermen geared up for offshore runs for tuna and king mackerel.

Before long, everybody was fishing for the same thing in the same place, says Bob Austin, a full-time fisherman from Williston. ''You go set two to three nets in the morning and when you get back there's a 100 on top of you. There's so many of us at it, it crowds the market,'' he says.

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Contaminated oyster beds were left untouched, only to paint a pretty picture

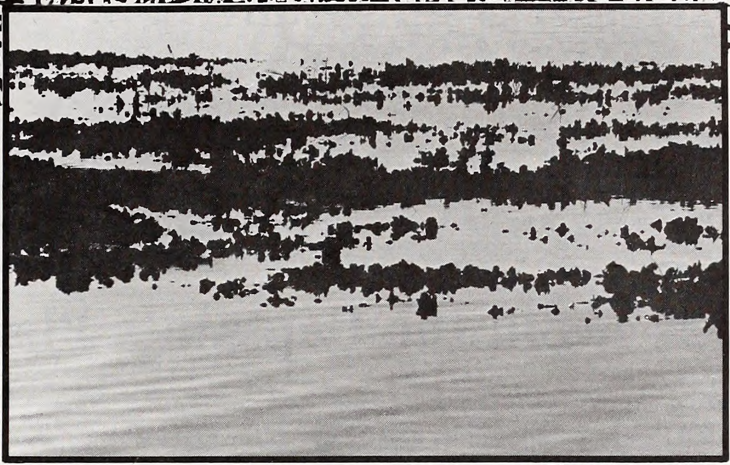

Photo by Scott Taylor

The saturation plus less demand for finfish forced prices down, Austin says. Where he once got 50 cents a pound for croaker, now he gets 22 cents.

Commercial fishermen in Florida, Connecticut and Texas faced a similar scene last year.

In Calhoun County, Texas, more than 2,500 shellfishermen lost $100,000 a day during a red tide outbreak. It washed over the bays in September 1986 and kept the oyster season closed until November, says Joe Surovik, a marine agent with the Texas Agricultural Extension Service.

Researchers found the toxin residual in oysters, so the state closed the 1987 season, too.

The outbreak not only hurt commercial fishermen, it affected tourism and ruined the county's recreational fishing industry, Surovik says.

Relief came slowly, mostly from state and local organizations willing to fry a fish, flip a bingo chip or hand out food donations.

Getting help for North Carolina's fishermen and seafood businesses took time, too.

In November, the federal Small Business Administration denied a plea for low-interest loans on grounds that red tide did not classify as a natural disaster. Congress rescinded red tide as such a disaster by an act in 1981.

But North Carolina's congressional delegation was not daunted. In late December they passed a bill declaring the red tide infestation a disaster in North Carolina, making the loans available after all.

Back home, the state allowed commercial shellfishermen to relay oysters and clams from polluted areas to cleaner waters for $1 a bushel. Fishermen could harvest and replant up to 500 bushels per week.

Money for house or boat payments was also made available through the state's Community Service Block Grant program.

And the deadline to purchase 1988 commercial fishing licenses was moved from February 1 to March 31.

Fund raising took a different turn in Raleigh where a contingent of Florida fishermen and seafood dealers held a fish fry December 19 to benefit their northern neighbors. With the help of the N.C. Fisheries Association, they cooked 5,000 pounds of grouper, mullet and black drum fillets and reeled in $10,000 for the state's needy fishermen.

In the coastal counties, employers or employees who pay unemployment insurance can file for aid. But most fishermen do not qualify.

Social services can help with food stamps and utilities.

Although counts of participants are up, especially in Carteret County where one third of the state's commercial fishermen work, most families have not applied.

''You're dealing with some very proud people, some very independent people,'' says Dennis Moffett of the N.C. Division of Emergency Management. Asking for help isn't part of their nature.

Photo by Scott Taylor

Signs closing waters to shellfishing were posted along 200 miles of the Tar Heel coast

That's why Neal Lewis and friends decided to provide some aid.

Lewis, executive director of the Carteret County Chamber of Commerce, helped organize an effort to distribute Thanksgiving turkeys. The success of ''Love Tide'' spurred the community to plan more events for Christmas and the rough months to come.

No matter how tough it gets, most of North Carolina's fishermen try to stay on the water, says Clinton Willis, a Smyrna fisherman and president of the Carteret County Waterman's Association.

They help each other. They fish regardless of the money.

For one thing, Willis says, four generations of Willises have fished before him.

Plus, ''It's just like the circus,'' he says. ''You go there and it's hard to get the sawdust out of your nose.'' With fishing, ''I can't get the salt out of my blood.''

Seafood Lovers Avoid the Captain's Platter

By Nancy Davis

Banned shellfish scared consumers away from otherwise safe seafood

Photo by Scott Taylor

Uncle Henry's Oyster Roast has seen some bad seasons . . . but none as bad as this one.

When the toxic red tide swept into North Carolina and closed 200 miles of the state's coastal waters, it nearly wiped out the Wilmington restaurant's business.

November and December are peak months for oysters, the restaurant's specialty. Usually at that time of year, Uncle Henry's does about $1,700 worth of business each week.

But this year, red tide got the best of that business.

In early December, the restaurant was taking in less than $100 a week.

Henry Kirkum, the third generation of his family to operate Uncle Henry's, says, "People just quit eating everything. They just don't even come in."

Red tide dealt a blow to North Carolina's seafood industry. But consumer fear struck a knock-out punch that left some owners of small seafood restaurants and markets struggling to get back on their feet.

Shellfish—oysters, clams and scallops—in affected areas were banned. But finfish, shrimp and crabs were safe to eat.

Even so, consumers were wary. And many swore off seafood altogether.

The result: the red tide took a larger toll on the seafood industry than it had to.

Seafood experts say the toxic algae affects only shellfish. Although the red tide may kill some finfish, fish are safe to eat. The algae doesn't concentrate in the flesh of a fish. Instead, it kills the fish by paralyzing its gills or by reducing oxygen levels in the water.

But seafood consumers didn't trust what they were hearing. And even pictures of Gov. James Martin sampling North Carolina seafood did little to change folks' minds.

The effects of the red tide rippled through coastal North Carolina like the Domino effect. First fishermen, then seafood dealers, and eventually, restaurant and hotel owners suffered.

A report released by the N.C. Division of Marine Fisheries estimated that more than 600 coastal businesses were losing millions of dollars because of the red tide. About 9,000 commercial fishermen were affected.

It couldn't have happened at a worse time. Fishermen count on the shellfish for Christmas money. And seafood dealers usually see business pick up during the holiday season.

"From the individual clammer whose livelihood is at bay, it's trickled down to people who truck the clams to people who serve the clams in restaurants," says Doug Brady, owner of Meridian Seafood, a wholesale and retail seafood business in Morehead City.

Brady estimates his business dropped by 80 percent because he couldn't convince his customers that seafood was safe.

"I've had people come in here who have lived on the coast all their life and say, 'I want some fish. Can you get me some from out-of-state?'" Brady says.

During the holidays, traditionally a popular season for seafood, Wilmington seafood dealer John Peterson usually sells about 60 gallons of shucked oysters.

This season, he sold 20 gallons.

The oysters came from Virginia, several hundred miles from the North Carolina waters affected by red tide. But folks were afraid the oysters had come from contaminated waters.

At the Bridge Tender Restaurant in Wilmington, manager Bob West took an educational approach to the problem. He trained his wait staff to answer customers' questions about red tide.

West also made sure his staff knew where the restaurant's seafood came from.

Fortunately for West, the restaurant's bill of fare included more than seafood. He noticed a sharp rise in orders for prime rib and steak.

Many coastal businesses have accepted this season as a loss. But seafood retailers and restaurateurs are optimistic. They think that once the red tide has diminished, folks will start buying their product again.

But if the red tide returns, as some scientists believe it will, the seafood industry wants to be prepared.

For dealers in the southern part of the state, that means banding together to form the Cape Fear Seafood Dealers' Association.

Peterson, president of the newly-formed association, says the group will be ready next time red tide hits. They'll mount a public relations campaign to be sure folks know that some seafoods are safe.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

In the September *Coastwatch*, we told you about Sea Grant agent Jim Bahen's efforts to work with a netmaker to develop an inexpensive turtle excluder device or TED. Come May 1, federal regulations will require shrimp trawlers 25 feet in length or longer to use TEDs in offshore waters in North Carolina. The devices are designed to exclude endangered sea turtles from nets.

So far, the National Marine Fisheries Service has certified five types of excluder devices. The structures vary from aluminum boxes to deflector grids to web screens. The web screens are called "soft" TEDs.

Bahen's new TED is of the soft variety. Nicknamed the "Parrish" TED after inventor Steve Parrish of Supply, this excluder device awaits final approval by NMFS.

In October, it passed field tests. The Parrish TED barred all sea turtles from the shrimp net's tailbag.

The Parrish TED, made of 8-inch webbing, deflects turtles downward through a 40-inch hole in the bottom of the net. The opening is held rigid by a rectanglar bar and closed with an elastic chord.

But pressure from a large object such as a turtle will cause the opening to gap and allow the turtle to escape.

The Parrish TED is sewn into the net between the main body and the tailbag. Bahen says it is easy to install and costs $80 to $100.

For further information about the Parrish TED, call Bahen at 919/458-5498.

The N.C. Division of Marine Fisheries has $73,200 that it plans to use to help North Carolina fishermen buy TEDs. Details of the DMF's TED Purchase Program will be presented in a series of six public meetings held along the North Carolina coast the last week of February. The meetings will be cosponsored by Sea Grant.

At the meetings, Sea Grant agent Jim Bahen will present information about and show models of the different kinds of TEDs, provide hand-outs and summarize their performances. A DMF representative will outline the purchase project — how to apply and receive money for buying a certified TED.

The meeting schedule is as follows: Monday, Feb. 22, 7-8:30 p.m., Brunswick County Agricultural Extension office, Bolivia; Tuesday, Feb. 23, 8:30-10 a.m., New Hanover County Agricultural Extension office, Wilmington; Wednesday, Feb. 24, 7-8:30 p.m., Sneads Ferry Volunteer Fire Department, Sneads Ferry; Thursday, Feb. 25, 7-8:30 p.m., N.C. Division of Marine Fisheries, Morehead City; Friday, Feb. 26, 7-8:30 p.m., Pamlico County Agricultural Extension office, Bayboro; Saturday, Feb. 27, 9:30-11 a.m., Hyde County Agricultural Extension office, Swan Quarter.

The money will be available to fishermen in early March. It comes from the N.C. Department of Commerce's Energy Division. It was distributed to the state by the federal government for use in energy efficiency projects. The money had been collected from oil companies that were penalized for overcharging consumers in the 1970s.

TEDs increase energy efficiency by reducing the drag on nets created by turtles and other bycatch.

For more information about the meetings, contact Bahen at 919/458-5498.

The N.C. Commercial Fishing Show is making waves as one of the biggest boat and gear shows in the Southeast. The seventh annual show promises to be no exception.

March 11 to 13, boat dealers and marine manufacturers will display their lines at the Crystal Coast Civic Center in Morehead City. Representatives will show the latest in fishing boats, nets, motors, traps, pots, engines and accessory gear.

And seminars will be offered on commercial fishing topics.

The show is cosponsored by UNC Sea Grant and the Carteret County Waterman's Association. Merchants interested in participating should call Sea Grant agent Bob Hines at 919/247-4007.

The winter months may be too cold for sunbathing at the beach, but they're just right for planting. If you're a coastal property owner, this is the time to protect your investment with beachgrasses, shrubs and ground cover.

And Sea Grant has several guides that can help you.

Seacoast Plants of the Carolinas for Conservation and Beautification is a general guide on the use of plants for landscaping and stabilizing coastal soils. It contains illustrated descriptions of over 100 plants that are native to the North Carolina coast. Ask for UNC-SG-73-06. The cost is $4.50.

Building and Stabilizing Coastal Dunes with Vegetation provides instructions on transplanting, fertilizing and maintaining dune grasses with detailed information on species. Ask for UNC-SG-82-05. The cost is $1.50.

Planting Marsh Grasses for Erosion Control provides a guide to transplanting, fertilizing and maintaining marsh grasses for estuarine erosion control. Ask for UNC-SG-81-09. The cost is $1.50.

Remember, coastal property is dynamic. A few dollars for these books and the plants recommended will be worth it if it helps keep those sandy soils from sifting away.

Continued on next page

When Sea Grant agent Wayne Wescott visits his clientele, it's usually fishermen in Hatteras, Colington, Edenton or Engelhard. But in late January, Wescott made a visit that was out of this country.

He traveled to Turkey to provide advice for developing a soft crab shedding industry on the shores of the Mediterranean Sea. The Turks harvest a species of crab that is similar but slightly smaller than our blue crab.

But the Turks know nothing about shedding their crabs into soft-shell delicacies. That's why Wescott, a nationally renown shedding expert, was asked to make a visit.

The trip was paid for by a multinational corporation, Destek International. The company plans to develop the soft crab as an alternate food source for the people of Turkey.

Sea Grant Marine Advisory Service Director Jim Murray is conducting an assessment of artificial reef programs in the Mid-Atlantic and Southeast.

In the study funded by the N.C. Division of Marine Fisheries, Murray will interview fisheries managers from New Jersey to Texas to find out how each state conducts its program.

When the study is complete, DMF will use the information to formulate a plan for North Carolina's artificial reef program.

UNC Sea Grant has received its funding for 1988. The program was allotted $1,184,000 — the same amount it has received for the past two years.

You've got L.L. Bean and Spiegel at your fingertips. And now, you can add the Sea Grant catalog to your magazine rack.

It's chocked full of publications that provide advice on everything from shrimping to landscaping. There's something for the tourist, the fisherman, the boater, the conservation-minded and more. Many of the publications are pictured, and there's a form for convenient ordering.

Don't miss out on a single bit of Sea Grant information.

Order it now. It's free, and there's something in it for everyone.

Ask for UNC-SG-88-03.

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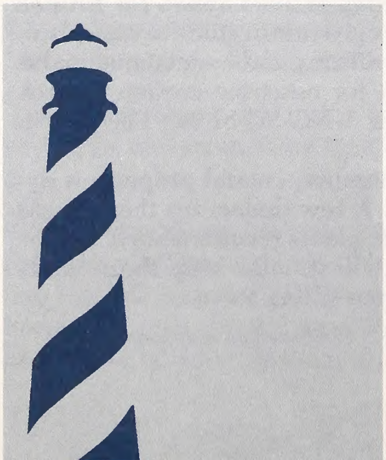

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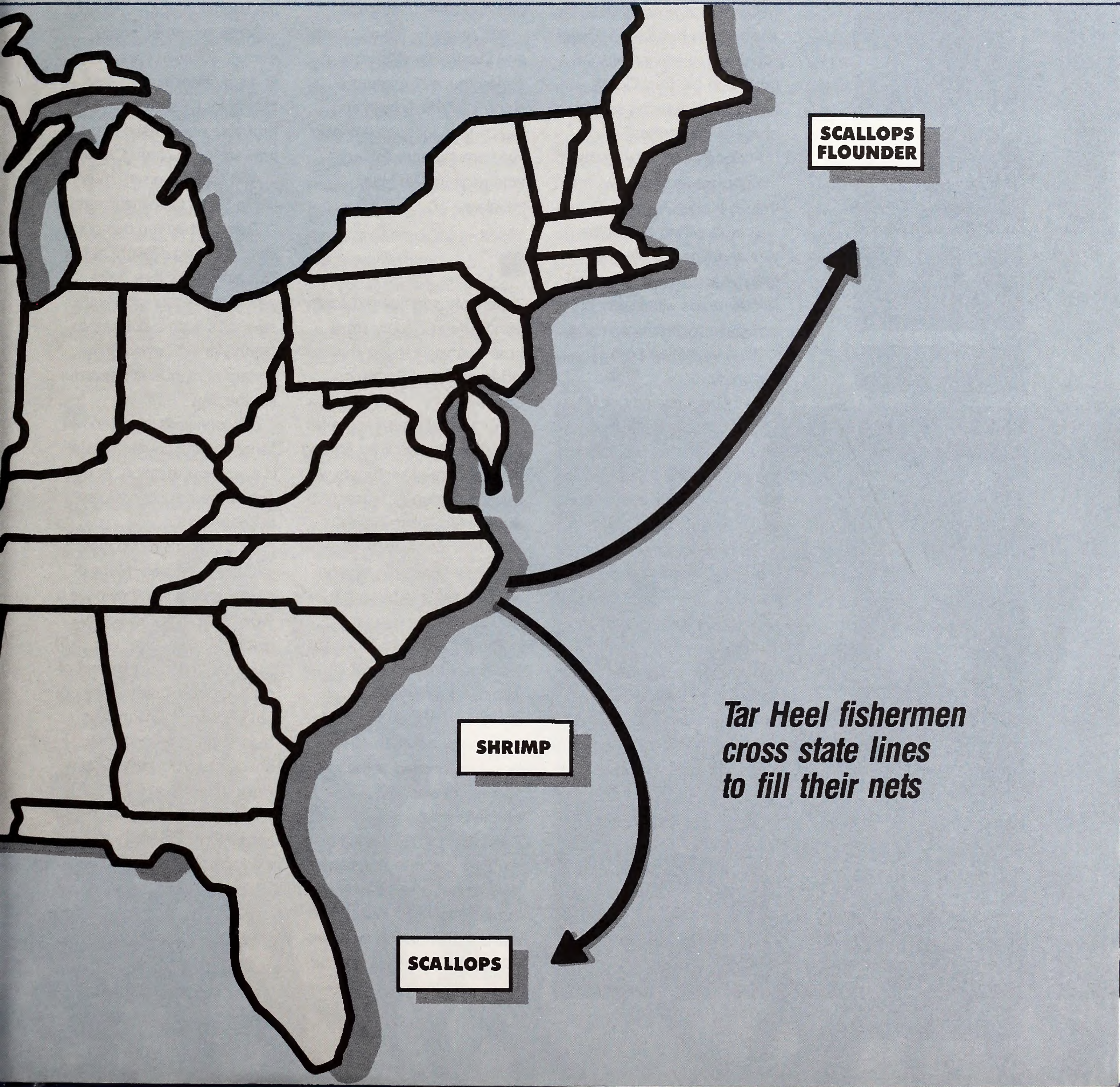


*Tar Heel fishermen
cross state lines
to fill their nets*

N.C. FISHERMEN

Researchers find fishermen live up to their reputation

By Kathy Hart

North Carolina fishermen have made themselves a reputation.

You can hear it whispered on the docks in McClellanville, S.C.; Cape Canaveral, Fla.; and New Bedford, Mass.

Off one person's lips, it's said with respect; off another's, there's a mixture of spite and jealousy.

But no matter where it's whispered or how it's said, it is a reputation that links Tar Heel fishermen to every major fishery on the East Coast.

Just what is being said about our fishermen?

For one thing, they're smart.

But more importantly, they're mobile.

They're willing to kiss the wife and kids goodbye for months at a time so they can fill their holds with seafood and their pockets with money.

It's a reputation born of necessity.

Sea Grant researcher Mike Orbach says there is no one North Carolina fishery that has the abundance, value or availability to support a fisherman and his family year-round.

Tar Heel fishermen must either switch fisheries within the state or go out-of-state to extend seasons or to follow the fish.

Many fishermen are choosing to cross state lines—to challenge fishermen from New England to Florida and sometimes beyond—for their catch.

But when the harvesters go to other states or regions, it creates unique interdependencies between fishermen, seafood dealers, processors and management agencies.

These interdependencies and the lifestyle of North Carolina's transient fishermen sent three East Carolina University anthropologists roaming out-of-state docks as part of a Sea Grant study.

Jeff Johnson, Mike Orbach and Danny Rasch surveyed three groups of migratory North Carolina fishermen. Rasch and Johnson actually lived among and worked alongside the Tar Heel travelers.

■

Jeff Johnson headed south with Carteret County small-boat shrimpers to the shrimp-laden shores of South Carolina.

For several weeks in the fall of 1986, Johnson lived among a contingent of shrimpers who docked in muggy, moss-draped McClellanville, S.C. They had come south to extend their shrimping season after a mediocre harvest in the Tar Heel state.

The shrimpers hailed from Downeast towns—Harkers Island, Marshallberg, Davis and Stacy. But, during the fall, home was the 21- to 45-foot boat they docked at the seafood dealer's in McClellanville.

Usually Tar Heel shrimpers sell their catch to the same seafood dealers year after year. In return for their loyalty, the dealers provide the travelers with a few amenities and advance information about expected shrimp yields.

If North Carolina waters yield a bumper crop of shrimp or the crustaceans are few and far between in Sandlapper country, fishermen stay home.

It's the so-so years that send shrimpers south. But the shrimpers acknowledge that there are social reasons for the migration, too.

Some fishermen like to shrimp, Johnson says. They find it more enjoyable than fishing for finfish, which they probably would have to do if they stayed in North Carolina.

And fishermen say, shrimping in South Carolina is easy.

There, fishermen can only shrimp during daylight hours. "It's almost like they have a nine-to-five job," Johnson says. "It's such a contrast to North Carolina where they shrimp at night and sleep during the day."

Johnson says for some fishermen the southern jaunt is a working vacation. At the docks, there is often a party atmosphere.

It's a very male-dominated gathering, he says. Many of the fishermen feel they have a reprieve from home-bound responsibilities.

Although families are out of sight, it doesn't mean they are out of mind, Johnson says. Most shrimpers arrange to drive or carpool home every week or two to see the family.

Despite almost yearly migrations, North Carolina's traveling fishermen don't figure into

South Carolina's fishery management plans.

"State management agencies take care of their own," Johnson says. "They hardly know anything about transient fishermen, and they don't know how their decisions affect fishermen in other states."

For now, Tar Heel shrimpers buy a South Carolina commercial fishing license and adhere to Sandlapper regulations just as native fishermen do.

All in all, Johnson was impressed by the ingenuity and mobility of North Carolina's small-boat fishermen.

"Sure I'd seen the big boats on the West Coast travel hundreds of miles to participate in a fishery," Johnson says. "But when you see a fisherman take a 26-foot boat 200 to 300 miles to catch shrimp, that's surprising."

◆

Danny Rasch signed on for the long trips of Wanchese's big boats as they ply northern waters for flounder and sea scallops.

The 80- to 120-foot Wanchese boats usually follow the herds of flounder along the New England coast from March until late fall. But if the sea scallop harvest is favorable, the captains re-rig for the mollusks during the summer.

The trips offshore usually last from nine to 12 days for flounder, 11 days for scallops. And most boats have a five-man crew and captain.

Rasch says the captains establish a rotation system for the crew. Each week one crew member flies home while the others stay behind to work.

The captain works trip after trip "until he can't stand it anymore," Rasch says. "Then everybody takes a week off."

Rasch says the work, especially aboard the flounder boats, is grueling. From the first haul of flounder until the last, the crew works two hours, then rests two hours. On the scallop boats, the crew works six-hour shifts.

If the catch is poor during a trip, the captain and crew may spend a few extra days at sea netting "shack" fish—nontargeted species such as lobster, mudfish and monkfish. Rasch says that bringing in a good haul of shack fish can mean an extra $200 to $500 per crew member.

If you think these Tar Heel fishermen are a tough lot, you should meet their wives, Rasch says. "I have real respect for the wives of these fishermen.

"They can never plan anything," he says. "They never know how long their husbands will be away or how much money the men will make."

That's why Rasch says that it is important for the women to have multiple sources of funding—parents, other relatives or friends.

Besides financial worries, the women must also endure the loneliness of being away from their husbands. That's where the support of a community as tight-knit as Wanchese comes into play, Rasch says.

When North Carolina fishermen finally slide into New Bedford's harbor, they dock at the same pier.

The New Bedford docking system is segregated, Rasch learned. Portuguese fishermen claim one pier; New Bedford natives, another. And the third pier is strictly for North Carolinians.

Off the boats, the North Carolina fishermen stay to themselves, Rasch says. They don't interact with New Englanders unless it's a matter of business.

New Bedford businessmen like the Tar Heel fishermen.

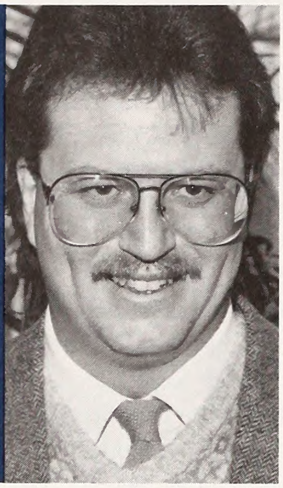
"They tell me the Southerners are more gentle, don't fight as much and are prompt in paying their bills," Rasch says.

But New Bedford fishermen, native or Portuguese, have different opinions. They consider their southern counterparts "red-neck scum" who take their jobs and steal their fish, Rasch says.

But they shouldn't speak too loudly if they want to sell their catch. North Carolinian Kenny Daniels of the Wanchese Fish Co. buys all the flounder unloaded at the New Bedford docks.

New England fishermen aren't the only ones who don't give North Carolinians much respect. The New England Fishery Management Council ignores Tar Heel flounder

Fishermen take small boats like these south to shrimp



Danny Rasch

fishermen despite a 30-year participation in the fishery, Rasch says.

But the council did recognize North Carolina scallopers in the early 1980s when they entered into a fray over a proposed size limit for sea scallops.

■

Mike Orbach surveyed Carteret County fishermen who periodically dash off to the Florida coast to cash in on the lucrative calico scallop harvests.

In the fall and winter, 20 to 30 North Carolina fishermen occasionally hightail it to Florida's northern Atlantic coast to scoop up calico scallops from newly discovered beds.

All it takes is a call from one of the scallop processors in Florida. Many of the processors have ties or even processing plants back in North Carolina.

In fact, North Carolinians have dominated this Florida fishery since the first large beds of calico scallops were discovered in 1980.

Fishermen from Wanchese to Swansboro headed south. Nearly half of the scallop fleet working out of the Canaveral docks in the early 1980s were North Carolinians. Some fishermen even moved their families to Florida.

The lure?

"The scallops carried a high value, and it was a dead-easy fishery," Orbach says. "Everybody knew where the beds were. All the boats had to do was go to the beds, shovel up the scallops, head back to the docks, unload them and go out again. They worked 24 hours a day."

North Carolina processors cashed in, too. Much of the machinery needed for shucking the scallops sat in plants on the shores of Carteret County.

Truckload after truckload of calicoes was hauled to North Carolina for shucking. But eventually the processors moved their equipment south.

And just as the South Atlantic Fishery Management Council set its sights on a calico scallop management plan, the fishery collapsed.

Tar Heel scallopers headed home, and the management plan was shelved.

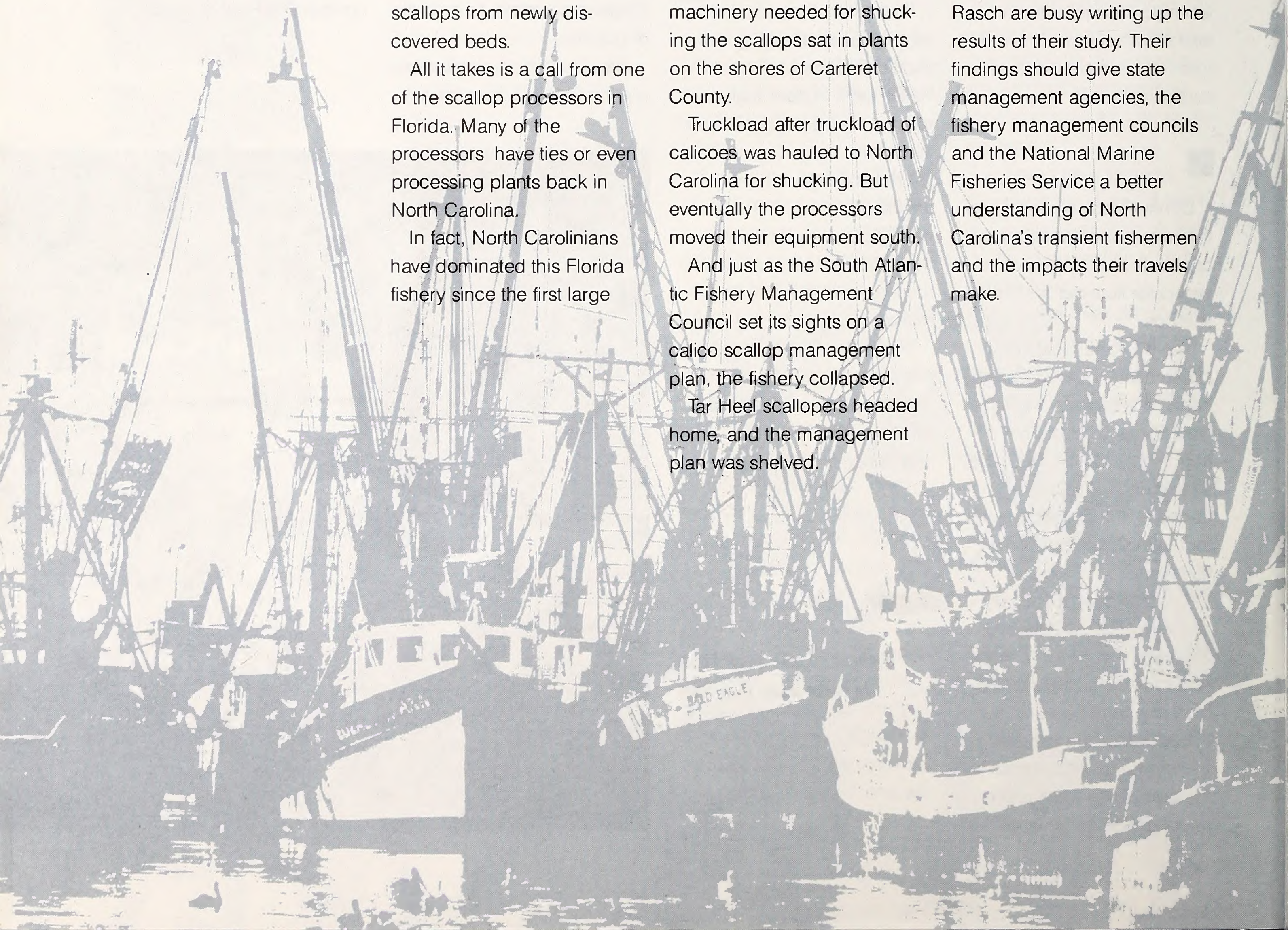
But in recent years, new beds of the calicoes were found, and processors called in their fishermen friends from North Carolina again.

Because of North Carolina's dominance in the fishery and in the processing, there has been little conflict and resentment over the Tar Heel invasion, Orbach says.

And the South Atlantic Fishery Management Council is eager for the results of this study. If the fishery booms again, the council wants to be prepared with as much information as possible, Orbach says.

■

Johnson, Orbach and Rasch are busy writing up the results of their study. Their findings should give state management agencies, the fishery management councils and the National Marine Fisheries Service a better understanding of North Carolina's transient fishermen and the impacts their travels make.



N.C. FISHERMEN

Fishermen explain what lures them to travel

By Nancy Davis

The black lettering on the stern of Punk Daniels' fishing boat proclaims Wanchese as its home port.

But the words are deceiving. The 70-foot "Venus" is just as likely to dock in ports in Maine and Canada as in North Carolina.

The days of the provincial commercial fisherman are gone. To bring in money year-round, Tar Heel fishermen say they must look beyond the waters their grandfathers fished.

The result is a breed of fisherman that is mobile, aggressive, smart, industrious and business-like.

For months at a time, Daniels and fellow Tar Heel fishermen leave home and family hundreds of miles behind. And back in towns like Wanchese, Marshallberg and Supply, wives and children wait for a weekly phone call, a monthly visit and a paycheck in the mail.

And whether they're scalloping off the coast of Maine or shrimping the waters around Key West, Fla., they command respect, and sometimes resentment, from their counterparts in other states.

"Fishing hasn't been real good here in North Carolina, so a lot of these people are having to go far and wide to make it in the business," says UNC Sea Grant Director B.J. Copeland. "Some people are going to be amazed at the distances these guys go for fish."

Some North Carolina fishermen migrate to neighboring states when the pickings are slim here. Others travel as far north as Canada and south to the Florida Keys.

Wanchese fishermen are likely to go north to fish for flounder and scallops. Fishermen from the state's central and southern coast often travel south to shrimp.

Marshallberg fisherman Jerry Kellum says he would fish in Core Sound all year if he could make a profit on his catches of shrimp, oysters and clams.

"If there's something here, I'll stay here," he says. "But I just move around so I can catch more and make more."

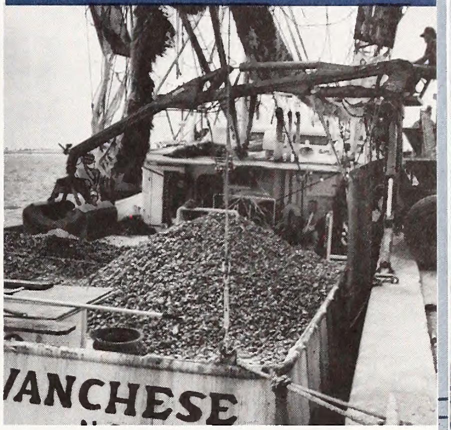
For the past few years, Kellum has taken his 30-foot trawler to South Carolina waters where shrimp have been more plentiful.

Daniels starts fishing on the "Venus" in January around Cape Hatteras for flounder. He works his way north along the coast until he ends up on Georges Banks off the coast of Maine and Canada in April.

If the price of flounder drops, Daniels rigs his boat for catching porgy and sea bass.

Hobucken fisherman Forest Williams owns three boats, ranging from 73 feet to 87 feet.

His crews fish for flounder in New Jersey waters in the fall. They follow the fish south until they're in Virginia Beach by the first of November. Then they work along the Carolina beaches until the fish move back north to deeper waters. When summer approaches, Williams' crews will shrimp off of North and South Carolina or scallop off Cape May, N.J.



Tar Heel fishermen cash in on this bountiful harvest from the Florida coast

North Carolina's traveling fishermen approach their profession for the business it is. They know that a successful fishing season has little to do with luck. It depends on old-fashioned hard work, they say.

And sometimes their success riles the fishermen in other states.

"I reckon sometimes they feel like they'd get along better if out-of-state boats would stay at home," says Red Brooks of Harkers Island.

Daniels, who says some Northern fishermen resent the North Carolina presence in their territory, has a comeback ready for them.

"We just tell them the war's over," he says. "We have to work hard. We don't care whose waters we're in."

Williams says any resentment is unfounded. He likens it to a deer hunt.

"If I was going deer hunting in my own back yard, I'd know where to look and where to kill me a deer. But if a fellow from Beaufort came over, he wouldn't know where to find him a deer.

"Well, it's the same way up there," Williams says. "We're in their back yard.

"North Carolina fishermen are aggressive. We hear it all around. It's what we do for a living. We're hard workers. It's a real competitive business. When you're in competition, you're going to go that extra mile, and North Carolina fishermen are willing to do that," Williams says.

The hard work pays off in bigger catches, Kellum says. And that can create animosity. "From past experiences, I think North Carolina fishermen catch more than South Carolina boats," he says.

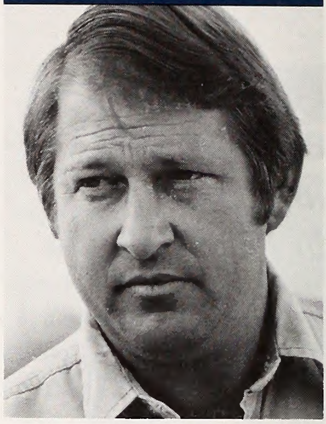
Because North Carolina shrimpers have smaller boats, they are able to fish in shallow, nearshore waters. They catch the shrimp as the crustaceans move from their inland nursery grounds offshore to spawn in deeper waters.

South Carolina fishermen believe the Tar Heels catch a disproportionate number of the shrimp before they get to the deeper waters.

Complaints fill the air waves. "I hear them talk about it on the radio. 'Those North Carolina folks are down here cutting us off,'" Kellum says.

But Kellum has some advice for the disgruntled: Get smaller boats so you can compete with North Carolina boats.

Traveling fishermen also must deal with the pressures of being away from their families for weeks, sometimes months, at a time.



Forest Williams

"It's tough being away and staying on a boat," Brooks says. "I'd rather stay at home."

Daniels' crew on the "Venus" may be away from home for as much as a month at a time. They keep in touch with their families in Wanchese via a cellular phone on the boat. And their wives may drive or fly up for a visit every now and then.

Williams admits, "It's a hard way to make a living."

But his crew members manage to get home as often as possible—usually every 10 to 15 days, he says.

Williams says he's heard the wives of his crew members say, "I'm glad he's gone. I was getting tired of him."

But the next day, the phone is ringing. "When is he going to be back in?" they ask.

"It's a honeymoon all over again when they come back in," Williams says.

Kellum says the months away from home are wearing on him, and he's considering moving to South Carolina for good. Oysters and clams are getting scarce in Core Sound, he says. And he figures he can make enough money just shrimping in South Carolina.

But for Williams, moving is not a choice. "I've got six kids in school, and this is my home," he says.

High prices and strong demand for shrimp draw fishermen away from home

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

If you're fishing for something fun to do this summer, consider North Carolina State University's 37th annual Sport Fishing School. Sponsored by the Department of Zoology and the Division for Lifelong Education, the school will be held June 12 through 17 in Hatteras. It is designed for folks who want to learn more about fishing for offshore big game fish. You'll cruise the Gulf Stream for blue marlin, dolphin, wahoo and tuna. And you'll learn about fishing in the surf, sounds and inlets.

The school is open to anyone, but registration is limited. Children under 16 must be accompanied by an adult registrant. The cost for the five-day course is $600. The fee covers classroom and surf instruction, boat charters for two all-day Gulf Stream trips, bait and a fish fry. Lodging is not included. For more information, contact Alice Strickland Warren at the NCSU Division for Lifelong Education, Box 7401, Raleigh, N.C. 27695-7401.

In February, more than 200 people attended Sea Grant's conference on growing hard clams. Participants, including commercial fishermen, aquaculturists, scientists and resource managers, came from as far away as Maine and Florida.

Financial support for the conference was provided in part by the N.C. Biotechnology Center, the Gulf and South Atlantic Fisheries Development Foundation and the Mid-Atlantic Fisheries Development Foundation.

If you weren't able to attend the conference, but would like information on growing clams, contact Sea Grant advisory agent Skip Kemp at 919/247-4007.

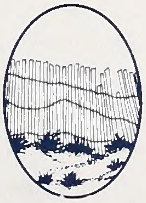
Joyce Taylor, Sea Grant's seafood education specialist, has produced another brochure in her seafood series. *Flaking Fish* describes how to make the flakes by poaching or steaming the fish, then flaking the meat away from the bone for use in other dishes.

Fish flakes provide additional ways to enjoy the nutritional benefits of seafoods. They are high in protein, but low in fat, calories, cholesterol and sodium.

You can use fish flakes as the primary ingredient in dishes such as salads and chowders or as an extender in preparations such as deviled crab.

For a copy of *Flaking Fish*, write Sea Grant. Ask for UNC-SG-87-05. The cost is 50 cents.

You also can order copies of the other brochures in the series: *Hooked on Fresh Fish and Shellfish*, UNC-SG-85-08; *Dressing Finfish*, UNC-SG-86-10; and *Bringing the Catch Home*, UNC-SG-86-26. The cost for each of the brochures is 50 cents.



Last year, severe erosion forced several South Nags Head homeowners to pick up and move. Literally. They had to take their belongings . . . and their oceanfront houses . . . to safer inland lots.

Such a move costs from $15,000 to $30,000. And until recently, homeowners had to pay every penny.

In December, Congress passed new legislation that changed all that.

The National Flood Insurance Program previously only reimbursed insured homeowners for actual damages to a building from erosion, says Spencer Rogers, Sea Grant's coastal engineer. Now the law grants insurees two new options in dealing with erosion's threats.

If a structure damaged by erosion cannot be saved, homeowners can receive up to 110 percent of its insured value to cover cleanup or demolition costs.

Homeowners who want to move houses from threatened areas will be eligible for payments of up to 40 percent of the total value of the building or 40 percent of the building insurance coverage. To receive the benefits, homeowners must adhere to certain restrictions, including moving the house to a location behind the 30-year erosion setback line.

To qualify for coverage, threatened buildings must be built along an ocean or inlet shoreline or a "lake or other body of water."

For details of the new program, contact your insurance agent. Or write Spencer Rogers, Sea Grant, Box 130, Kure Beach, N.C. 28449. His number is 919/458-5780.

Dune plants are the soldiers of the botanical world. They protect the dunes as they fight to survive. In the summer, they face intense heat and sunlight. In the winter, they meet the cold. Year-round they withstand ocean waves, salt spray and constantly shifting sands.

These hardy plants help stabilize our dune systems. Their flowers and berries add beauty to the beach, and many provide food.

Discover these fascinating plants with the new book *A Guide to Ocean Dune Plants Common to North Carolina*. Author E. Jean Wilson Kraus, botanist and educator at the North Carolina Maritime Museum, introduces more than 75 species of grasses, vines, herbs, shrubs and trees found on our coastal dunes.

Detailed illustrations and descriptions of each plant, as well as accurate keys, help in identification.

Kraus also introduces the ocean

Continued on next page

dune environment and plant habitats and explains how plants survive the harsh conditions there.

This 80-page book is an excellent guide for botanists and beachgoers. And it is a helpful educational tool. *Ocean Dune Plants* was published by the University of North Carolina Press in collaboration with Sea Grant.

To order, send $4.50 to Sea Grant. Ask for publication number UNC-SG-87-01.

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Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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COASTWATCH

Willie Etheridge Jr.

fishing's patriarch

BY SARAH FRIDAY

ETHERIDGE

OWENS

CROCKER

Last year *Coastwatch* introduced you to three outstanding coastal Carolinians. This year we continue our tradition of honoring people who have helped shape the North Carolina coast.

In Wanchese, fisherman Willie Etheridge Jr. has earned a legendary status as a commercial fisherman and charter boat captain.

As director of the N.C. Division of Coastal Management, David Owens has achieved a reputation as one of the most progressive coastal managers in the country.

And boat dealer Kay Crocker has become the unofficial spokesman for the state's marine anglers.

It's easy to tell Willie Etheridge Jr. has been fishing all his life.

You can see it in his big, rough hands and hear it in his voice as he talks about his past 67 years.

He likes to talk about then and now. And the future. He mixes in a little religion and a lot of philosophy learned from toiling on the sea.

He talks about his family, too. How generations of Etheridges before him plied the same waters off Wanchese. And how his wife and four children pulled their weight through the years.

But most of all, Willie Etheridge Jr. likes to talk about fishing.

And for good reason.

Etheridge is one of the best known commercial fishermen and charter boat captains on the East Coast. More than 50 years on the water earned him a good living and almost legendary status in the fishing community. Even competitors admire him for his dedication, unselfish attitude, environmental bent and outspokenness.

On land, he's built an empire that includes a wholesale fish business and a seafood restaurant.

The bespectacled fisherman with the fuzzy red hair is retired now, but he hasn't slowed down.

Like one of his old trawlers, he'll be out on the water until he breaks down for good. He takes people fishing every day in the summer. And he's been fighting to have Oregon Inlet stabilized for years now.

Etheridge's penchant for hard work and persistence go back as far as his love for the water and its resources.

He likes to tell the story of the time his parents thought their little boy was lost or had run away, only to find him sleeping in a small boat in a creek beside their house.

Except for six years in the service during World War II, Etheridge stayed by that creek, making Wanchese and the waters beyond it his home.

At his parents' insistence, Etheridge attended school. But his real education came from fishing the nearby surf, rivers and sounds.

continued on page 2

Photo by Drew Wilson

Etheridge

continued

In the early 1920s, fishermen stalked species such as shad, herring and flounder, using nets and 15- to 2-foot rowboats or sailboats. Shrimp were not caught or eaten at the time. Summer meant catching spot, croaker and trout, and throwing out baited line for unsuspecting crabs.

Etheridge remembers the days before ice, when fishermen salted the fish, packed it in barrels and shipped it by boat to Elizabeth City.

There, they traded their catch for sugar, flour and other goods unavailable in Wanchese.

Ice and trucking came to Wanchese about the same time as the bridge from Manteo—the late 1920s.

The young Etheridge worked the coast with his dad, then. Together, they watched as the commercial fishing industry began to change. Sales improved, and more people were eating fish.

Fishermen quickly correlated fresh fish and profits and worked harder to meet the rising demand.

"The fresher the fish, the better it is," Etheridge says. "We have learned quality means a lot."

Because of the coast's resources, Etheridge says people in Wanchese didn't know much about the Depression. "We always had something to eat."

In 1937, with the help of President Franklin Roosevelt, Manteo got "the show." The outdoor drama, "The Lost Colony," put the region on the map.

"This place has really been growing since that day," Etheridge says. "In all this, the tourism grew just the same as our fishing improved."

The influx of vacationers gave rise to the Outer Banks' charter boat industry. After the war, Etheridge bought a boat and became a captain in 1946. He guided people to dolphin, amberjack, tuna and more for 17 years.

Summer chartering gave him the opportunity to throw out an occasional line. He even set records such as catching the first marlin off the North Carolina coast.

Docking his charter boat didn't mean slamming the brakes on Etheridge's fishing career; he just changed gears.

In 1963, he bought a trawler and fished commercially for 20 years for such species as lobster, flounder and shrimp from Massachusetts to Florida.

"I did right good in it," Etheridge admits. "I rasied a family and in a few years I started a business . . . a wholesale fish busines."

Fourteen years later, Willie R. Etheridge Seafood Co., Inc. thrives. His son operates the company, and his grandson, Willie Etheridge IV, helps out when he's home from college.

Oh, and there's a new Etheridge Seafood Restaurant down by the beach.

To Etheridge, success often meant change. He *always* shared his knowledge, and later in his career—his money.

Bobby Owens, chairman of the Dare County Board of Commissioners, attests to that.

"I would say his biggest contribution has been that he has perpetuated the seafood industry in Dare County," Owens says. "He is very astute, very knowledgeable of the sea. He makes a science out of the sea. He can almost smell the fish."

Willie III remembers his dad constantly trying new gear and fishing techniques, then sharing what he learned with other fishermen.

"Down through the years we've experimented and learned a lot," the elder Etheridge says. "We've improved our nets . . . We have learned electronics paid."

Before, fishermen concentrated on quantity—the more the better. But Etheridge taught them that fishing for species in high demand could bring them more money at the docks.

Etheridge also told others where to find the fish. And he often left schools behind, knowing it would help the stocks.

The Wanchese fisherman's unselfish attitude is rare in such a competitive business like commercial fishing.

"A lot of fishermen don't have the attitude I do," Etheridge says. "You'll find that (competitiveness) wherever you go. I never cared much for that. It's OK in a ballgame, but when you're out there making a living I don't think it should matter.

"We were always of the attitude to help somebody," he says. "If somebody's boat got burned, the fishermen would pass the hat, then help him build another boat.

"This attitude is kind of changing with development," Etheridge laments. "People have more money, are doing things for themselves, buying things for themselves."

Despite the worries of other fishermen, Etheridge remains optimistic about the future of commercial fishing.

"Fishermen are getting along better than they ever have in my lifetime," Etheridge says. "They're working more. They're more concerned about profit."

Consumers are eating more fish, so the demand is there.

And so are the fish, Etheridge says. Untapped resources like deep ocean waters miles offshore will provide enough fish for 50 to 100 years, he says.

Etheridge just wants to make sure the fishermen from his area can get to them. He's been campaigning locally and at the state and national levels to have Oregon Inlet stabilized. A mile-long jetty would help keep the pathway to the open seas clear, he says. And it would help make his region a "national fish haven."

"The fish are there," he says. "You learn they're there."

Etheridge likens himself to Peter in the *Bible* by saying many times he'd fish on one side of the boat and not catch a thing. Then he'd try the other and catch netloads of fish.

His persistence paid.

"I always made money," he says. "I always caught fish."

David Owens

coastal caretaker

BY KATHY HART

Twenty years ago, David Owens and some Elizabeth City high school buddies drove to the Currituck beaches for a day of fishing, swimming and fun.

Not long after the group spread their blankets and rigged their lines, a man approached. He told the teenagers they were on private property. They would have to leave.

They did.

But 18-year-old Owens thought the request was unreasonable.

"It didn't seem right even then for someone to force you away from the beach," he says.

It wasn't an incident Owens forgot.

In fact, it shaped his career. Today, beach access and the public's right to use the beach are important parts of Owen's job as director of the Division of Coastal Management.

But 13 years ago, beach access was just a vague notion to Owens. He was earning a combined degree in law and regional planning from the University of North Carolina at Chapel Hill when professor David Brower approached him to work on a Sea Grant project—one that involved research on the legal and planning aspects of beach ownership and access.

Owens agreed. He had seen the problem firsthand, and he was willing to do a year's worth of research and writing.

In 1981, the effort paid big dividends.

Using Brower and Owens' work, state Rep. Al Adams of Wake County and a passel of coastal legislators spurred the N.C. General Assembly to expand the Coastal Area Management Act to include a beach access program. The legislative team also passed a $1 million beach access appropriation bill.

Working with the legislators every step of the way was the young assistant director of the Division of Coastal Management—David Owens.

Today, North Carolina proudly boasts one of the best beach access programs in the nation—13 regional accessways (includes parking, restrooms and showers), 40 to 50 parking areas and hundreds of walkways.

Owens calls beach access a "fun" project, one that brought the division and the Coastal Resources Commission new respect.

Since the passage of the Coastal Area Management Act in 1974, the commission and the division had battled resistance from coastal officials and residents. Coastal folks didn't like the idea of a state commission and agency telling them what could and couldn't be done along their salty shores.

But the beach access program changed people's perceptions. They began to realize that coastal management could be beneficial and protect the resources they valued.

For Owens, beach access was a success story with a personal note of satisfaction. But there have been others.

He steered an innovative oceanfront management program through the CRC. The program, which was unpopular at the coast,

continued on page 4

Owens
continued

established oceanfront setbacks and banned seawalls.

"They (the CRC) decided not to sacrifice public beaches for upland development," Owens says.

And because of CRC's stand, North Carolina doesn't have to contend with vanishing beaches as in New Jersey or with the enormous beach renourishment bills of Florida.

Instead, North Carolina's oceanfront management program has been a model for coastal development in other states.

Although Owens doesn't cast a vote on the CRC, he and his staff provide the commission with the information they need to make their decisions and take their stands.

"When the CRC is confronted with a problem, they ask themselves what do we want the coast to be like in the future in respect to that problem," Owens says.

"To provide them with answers, we put together an analysis: What are the choices? What are the impacts of those choices," he says. "We tie the pieces together and provide the framework so the citizens' commission and legislators can do their work."

It's that ability to look to the future and to know what should be done that many say makes Owens so effective.

"Take the oceanfront management program, for example," says Kathy Henderson, the division's public information officer. "It started as something simple, but Dave followed it, pushed it when necessary and watched it evolve.

"It takes that kind of vision to see into the future and to know what it takes to get there," she says.

Sea Grant Director B.J. Copeland agrees.

"He's an effective leader," Copeland says. "In fact, I'd say he's the most progressive and capable coastal manager in the United States. And it's been his leadership as assistant director and director that has made the North Carolina coastal management program a model nationwide."

But what Henderson and Copeland see as foresight, Owens calls persistence and stubbornness.

"There are very few short-term problems in this business," he says. "Most of the problems we face take a long time to solve. You have to have continuity and tenacity to resolve them and make progress. And you have to be willing to take the short-term less glamorous steps to get there."

But Owens' reward is seeing results—watching the state acquire Carrot, Masonboro and Permuda islands as natural sites for preservation and "knowing that 20 years from now they'll look the same except for natural changes."

Although seeing a project come to fruition is rewarding, Owens knows that other problems loom ahead.

"There are very few permanent victories," Owens says. "There are always new developers standing at the door who don't understand the regulations or a new conservation group who doesn't know how to translate their ambitions into good works.

"Yesterday it was Masonboro Island; today, Buxton Woods; tomorrow, something else," he says.

For now, the controversy over Buxton Woods, the state's largest remaining maritime forest, is filling Owens' agenda. He's negotiating between landowners, conservationists and county government officials to determine the forest's fate.

"Sometimes I feel like Henry Kissinger with his shuttle diplomacy," Owens says. "Last week I was in Washington, D.C., to talk to federal officials. Then it was back to Manteo to talk to the county commissioners. And I ended the day on the phone with the lawyer for the landowners."

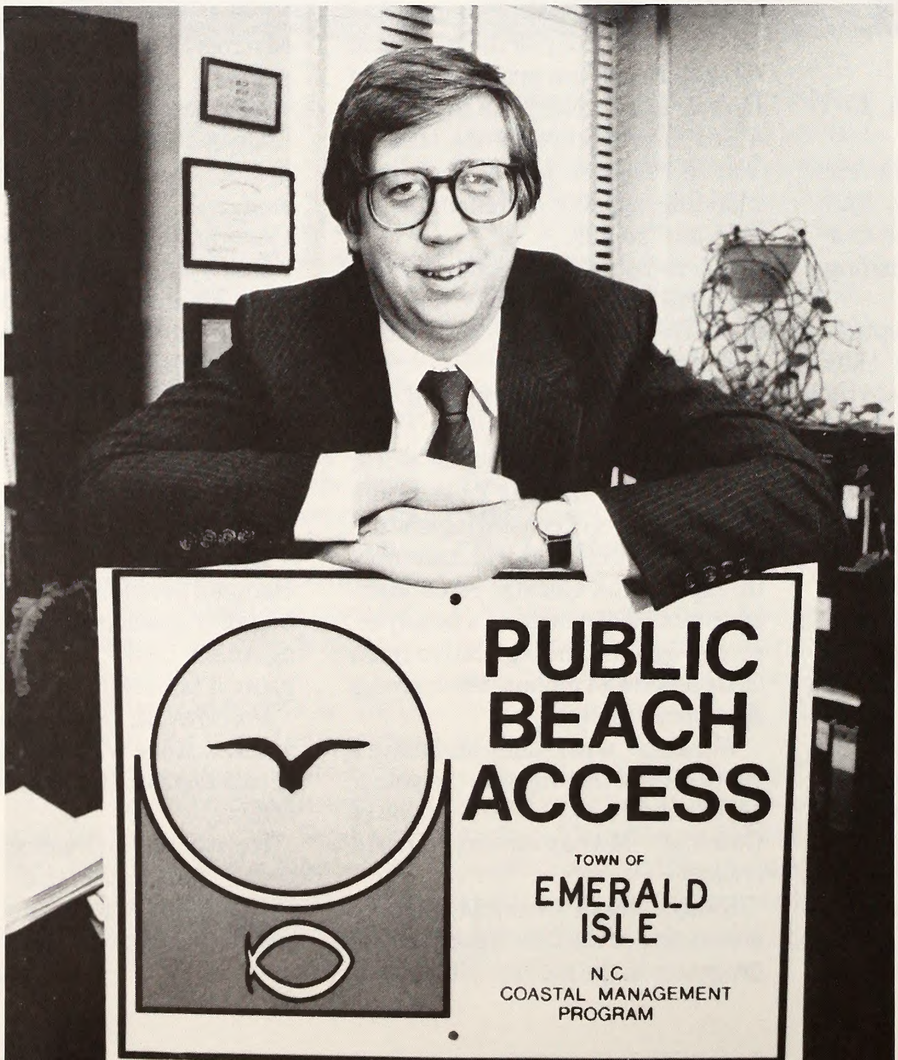


Photo by Jim Strickland

But Owens seems tireless when it comes to the job of balancing development and its economic rewards against preservation and its more subtle benefits.

"It's a lot easier to correct a problem than it is to prevent it," Owens says. "In North Carolina, we're in the fortunate position to prevent problems a lot of other states are having to correct. But it makes our job more difficult.

"It's hard for local government to swallow hard and make unpopular decisions, and it's hard for the governor and the legislature to spend dollars on coastal areas when they're faced with paving roads and educating children," he says.

But Owens says, fortunately the public reduces the pressure. He credits the state's seaside residents with a unique understanding of coastal processes.

"It's amazing how much people know and understand," he says. "They know about barrier islands and estuaries."

And Owens hopes that understanding carries to the future as the CRC and the division face some of the problems ahead—post-hurricane rebuilding standards, estuarine standards and the continued acquisition of beach access and natural areas.

But whatever the future holds, Owens hopes resource managers take some cues from the past.

"When I was 12 years old, it was easy to find places to play in the marsh mud," he says. "There were no condos or parking lots. I hope 50 years from now children have that same opportunity."

Kay Crocker

anglers' advocate

BY NANCY DAVIS

The customer gazed longingly at the shiny hull.

You could tell by the look in his eyes. He wanted that 27-foot Boston Whaler. He could see himself at the helm, feel his hands on the wheel and smell the salty air.

But boat dealer Kay Crocker woke the shopper from his dream.

"I'll be glad to wrap it up for you," he joked.

Crocker was peddling some of his finest vessels at a boat show in Raleigh recently. And his soft-sell approach was charming his customers.

He might not make the sale this time, but this man would be back.

As owner of Crocker's Marine in Wrightsville Beach, Kay Crocker is one of the leading boat salesmen on the North Carolina coast. And more importantly, he owns the franchise to two of the top sellers in the recreational boat industry—Boston Whaler and Grady White.

But Crocker's reputation is built on more than his salesmanship.

His easygoing manner and knowledge of the recreational fishing industry have earned him a job as an unofficial spokesman for anglers in the state.

And recreational fishermen are glad to have him on their side.

"He's as honest as the day is long," says Eddie Smith, owner of Grady White Boats in Greenville. "Kay is hard-working, has lots of integrity. And in terms of recreational fishing, he's one of the greatest spokesmen in the state. He's genuinely interested in protecting the fishery, and not just the recreational fishery."

When Crocker isn't minding his store, he's attending public hearings, urging new regulations for the fisheries, and lobbying the legislature—all at his own expense.

In his blue oxford shirt, belt with fish on it and leather topsiders, Crocker has the look of a recreational fisherman. And his booming radio voice is tailor-made for speaking his mind about recreational fishing.

"Man has a way of being a damn glutton," he says. "He'll catch all he can, and take it home and not use it."

Crocker's way with words has a way of making folks listen.

Sea Grant Director B.J. Copeland has watched Crocker in action at N.C. Marine Fisheries Commission hearings.

"Kay Crocker has spoken eloquently about those resources and how we need to protect them for all of us. He usually gives a balanced view and therefore maintains his credibility," Copeland says. "He does his homework, formulates a conclusion and delivers it very expressively."

And Crocker genuinely believes in his message. To prove it, in 1982 he helped found the Wrightsville Beach King Mackerel Tournament.

The proceeds of the tournament fund artificial reefs in the southeastern part of the state. So far, tournament profits have helped create reefs out of two tugboats, a barge and a dredge.

Crocker hasn't always been anchored in coastal Carolina. He grew up on a tobacco farm in Selma, N.C. After he graduated with a degree in history from Wake Forest University in 1962, he moved to Wilmington to be near the water.

He taught high school social studies for five years, but his ambitions changed the day one of his former employers took him charter boat fishing.

He was hooked. Pretty soon, he was running his own charter on weekends in a 36-foot Harkers Island-built wooden boat.

In those days, Crocker says, "You could take a four-hour trip out of Wrightsville Beach and catch 50 to 60 Spanish mackerel. Now the stock has been so devastated, you could

continued on page 6

Photo by Julie Macie

Crocker

continued

fish all summer and not catch that many."

By 1967, the urge to be on the water was too strong to ignore. He gave up teaching to become the captain of a 54-foot private motor yacht. He guided the boat to Florida for the winter and North for the summers.

Three years later, Crocker decided it was time to settle down. He returned to Wrightsville Beach, got married and started a boating business.

"Being dumb and foolish, I didn't even realize there was a recession going on. I had $600 in the bank. We lived off my wife's salary. It was four or five years before I ever drew a salary," he says.

But Crocker was a hard worker. Before long, he had obtained the Grady White franchise for southeastern North Carolina. Today it is one of the most lucrative small-boat franchises.

His one-man operation has grown to one with 15 employees, and he also owns an interest in a Morehead City boat store.

In his 20 years in business, Crocker has watched the recreational fishing industry change.

Most folks weren't prosperous enough in the 60s to own their own boats. But now, small boats are affordable to a lot of people, Crocker says.

"That's caused a lot more pressure on the fishing resource, but it's not an unrealistic pressure," he says.

As a spokesman for the industry, Crocker's opinions have a recreational bias, but he's always open to compromise. Conserving the fisheries is the most important consideration, he says.

"Government regulatory agencies have got to enact rules and regulations that conserve not only for recreational but for commercial fishermen too. And what's good for one is good for the other. But they may not be regulations we all want," Crocker says.

"One of my major concerns in recreational fishing is, through whatever means, we've got to conserve this resource for our children and grandchildren and future generations. And I'm talking about recreational and commercial. It doesn't make any difference," Crocker says.

Even so, Crocker feels commercial fishermen have an advantage when it comes to management decisions. "We know how many commercial fishermen there are because they buy a license. And they sell their harvest, so there's a dollar value on the industry," he says.

But Crocker says he often feels handicapped by a lack of quantitative information about the recreational fishing industry. Despite the widespread economic impact of recreational fishing, statistics on saltwater anglers are hard to come by.

"The legislature and other regulatory bodies have no indications of the value of recreational fishermen to North Carolina," Crocker says.

But he adds that the sheer numbers of the sportsmen are beginning to make legislators and policymakers take notice.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

The ad reads: BEACH HOUSE FOR SALE. Your eyebrows rise, your pulse quickens, and you read on. BRAND NEW TWO-STORY WITH A DECK AND GARAGE. ON THE OCEANFRONT.

Before you turn your daydream into reality, pick up a copy of *Your Place at the Beach: A Buyer's Guide to Vacation Real Estate.*

The attractive, 28-page booklet published by Sea Grant and the N.C. Real Estate Commission offers a thorough look at the fun and frustrations of owning coastal property.

Written by Walter Clark, Sea Grant's coastal law specialist, the booklet addresses the environmental hazards, ownership options and costs associated with coastal real estate. And it can help you know what questions to ask sellers, real estate agents, government personnel and attorneys.

Whether you want to buy a vacant lot, townhouse, condominium, cottage or time share, *Your Place at the Beach* can help you make informed decisions.

For a copy, write Sea Grant and ask for publication number UNC-SG-87-04. The cost is $2.50.

In the summer of 1983, an extensive blue-green algal bloom spread across the lower part of North Carolina's Neuse River. To learn more about the bloom and its causes, Sea Grant studied the factors that supported and sustained the algae's growth.

Researchers Robert Christian, Donald Stanley and Deborah Daniel, all of East Carolina University, examined how chlorophyll, nitrogen, phosphorus and carbon concentrations affected the bloom.

Their findings are published in the new Sea Grant working paper *Characteristics of a Blue-Green Algal Bloom in the Neuse River, North Carolina.*

For a copy, write Sea Grant and ask for UNC-SG-WP-87-2. The cost is $3.

In coastal North Carolina, spring isn't the only thing busting out all over. In late April and May, blue crabs also bust out of their winter shells. And for a few hours after the molt, the blue crab remains in a highly valued softened state.

To cash in on the crabs' increased value, many fishermen capture the premolt crabs and hold them until they shed their shells. The crabs can be shed in anything from a floating tray in the sound to an elaborate onshore shedding system.

And now Sea Grant agent Wayne Wescott has learned that crabs can be shed in well water. The use of well water eliminates water quality problems and the need for waterfront property.

To learn more about the well-water shedding system, send for Sea Grant's latest Blueprint, *Shedding Soft Crabs in a Closed Well-Water System.* The Blueprint describes how to build and set up the system.

Ask for Blueprint UNC-SG-BP-88-1. It's free.

If you'd like to know more about shedding crabs, everything from identifying peelers to marketing soft crabs, send for Sea Grant's *A Guide to Soft Shell Crabbing.* Written by Wescott, the 32-page illustrated booket describes harvesting methods, handling procedures and shedding systems.

For a copy, write Sea Grant. Ask for UNC-SG-84-01. The cost is $3.

When it comes to talking about their boats, most people go overboard.

But when maintenance is the topic, boaters often fall short.

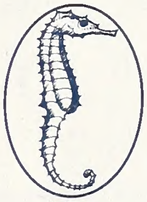
Proper year-round upkeep of boats, motors, trailers and other gear keeps equipment in good working condition and minimizes costly repairs.

This time of year, it takes special measures to de-winterize boats and ready them for the water.

Bob Hines, Sea Grant marine advisory agent at Pine Knoll Shores, has a few tips for checking boats.

Recharge the battery and clean the cables and connectors. Empty the old gasoline from the boat's tank and put in fresh gasoline. Check the boat's wiring for corrosion. Replace any bad terminals. Inspect and replace spark plugs. Wash and wax the boat. And make sure enough life preservers are onboard.

For a more extensive list, write Sea Grant for Hine's free Blueprint *Boat and Gear Preventative Maintenance.* Ask for UNC-SG-BP-81-7.



Lundie Spence is part travel agent and part salesman. Several times a year, Sea Grant's marine education specialist arranges exciting workshops to sell teachers on coastal ecology and biology.

This summer, Spence has two workshops on her calendar — one in Bogue Banks, N.C., and another in Puerto Rico.

In Bogue Banks, teachers will use a new curriculum developed by Spence and other specialists to focus on coastal environments. Activities incorporate physics, chemistry, biology and physical science. They are geared toward high school students.

The workshop, scheduled for July 24 to 30, is a joint program with Sea Grant, the N.C. Math and Science Center, and the University of North Carolina at Chapel Hill.

In Puerto Rico, 20 North Carolina teachers and 20 island teachers will investigate tropical coral reefs, mangrove systems, rain forests and marine grass flats from June 18 to 25. Aug. 13 to 16, the Puerto Rican teachers will travel north to Swansboro, N.C., to

Continued on next page

study similar ecosystems in our temperate climate.

Spence organized this program with educators from the Math and Science Center and UNC at Charlotte.

Funding for each workshop has been provided by Title II of the Education for Economic Security Act through the N.C. Math and Science Education Network.

For more information, write Spence at Sea Grant. Or call 919/737-2454.

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Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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November 1987

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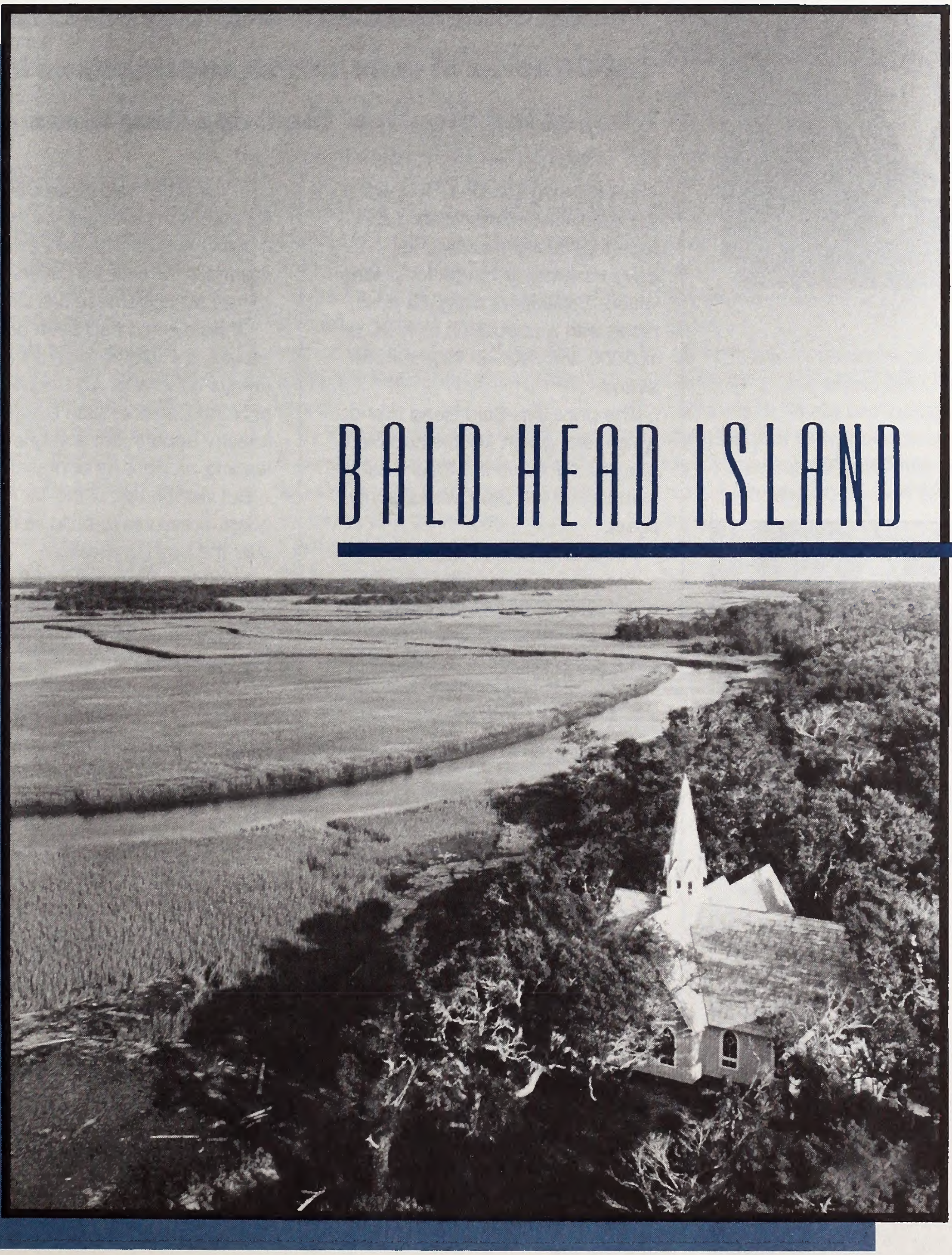
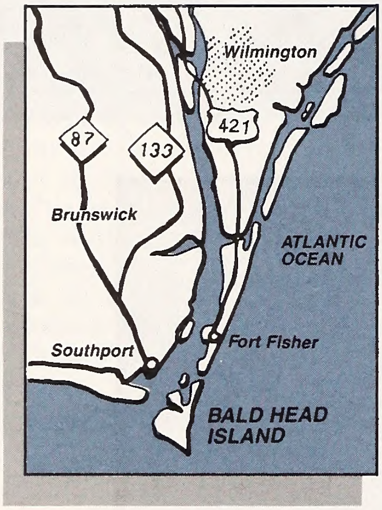
Photo by Nancy Davis



BALD HEAD ISLAND

Balancing development with conservation

BY NANCY DAVIS



The battleground was a small piece of paradise, 13,000 acres of sand, marsh and maritime forest lying at the mouth of the Cape Fear River.

It was North Carolina's first war of the coastal environment, and it raged for nearly two decades. Environmentalists fought for preservation. Developers sought a posh resort with a population as high as 180,000 and even an international airport.

The prize was Bald Head Island, which, along with Middle and Bluff islands, makes up the Smith Island complex off the Brunswick County coast.

In the end, neither side won.

Those who wanted the island to become a state park still shake their heads over a paradise lost. But there is a consolation, they say.

If the island had to be developed, its latest owner has created an acceptable blend of preservation and change.

The developer agrees.

"Bald Head Island should have been preserved," says Kent Mitchell. "But if it had to be developed, then I'm the best one to do it—without question."

On Bald Head, nature has united an odd combination of temperate and tropical life. Large stands of palm trees grow farther north than they're supposed to, and temperatures average several degrees warmer than on the mainland just three miles away.

At one time, Bald Head claimed the state's largest maritime forest. It is still the most popular nesting ground in the state for the endangered loggerhead sea turtle.

"If Bald Head had been preserved, it would be even more unique now," says Art Cooper, head of North Carolina State University's forestry department and one of the leading proponents of preservation.

But like the rest of the Tar Heel coast, pressures to build won out over the push to preserve.

Mitchell is the latest in a succession of owners, and his plans for the island are less ambitious than previous designs.

"My main overriding philosophy is, 'What is a place that I'd like to bring my kids back to in 20 years?'" Mitchell says. "There is a natural beauty that God gave this island," he says. "It is a wild, volatile environment, and I have a chance to preserve it."

In the 1960s, Smith Island complex owner Frank Sherrill proposed the most elaborate plans for a Bald Head Island resort.

But frustrated by state opposition to his plans, he offered the complex of islands to the state for about $5 million, a price the state considered too high.

So in 1970, Sherrill sold to

Old Baldy stands watch over the island

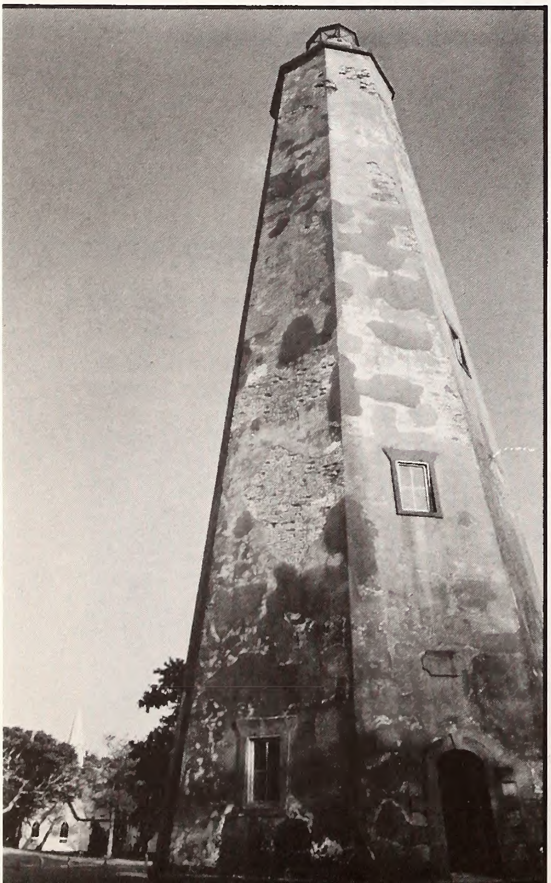


Photo by Scott Taylor

Carolina Cape Fear Corporation. That was the start of a 10-year battle with government agencies and environmental groups.

As a peace offering, Carolina Cape Fear gave Bluff Island and about six miles of oceanfront beach to the state. But by then, the company was drained. Mortgagors foreclosed, and Tar Heel native and Texas millionaire Walter Davis bought the island.

Davis continued the development, building a marina and Bald Head villas.

In 1983, Kent Mitchell and his brother visited the island. They convinced their father, another wealthy Texan, to buy the island. At the time, the senior Mitchell was described as one of the ten wealthiest men in the country.

Kent Mitchell, a Harvard architecture graduate, found himself caught almost immediately between his belief that the island should have been preserved and his desire to turn it into a model resort.

"We fell in love with the island before we bought it. We still love the island, and that's the tough battle," Mitchell says. "It's a tough compromise between making money and maintaining the balance with the environment."

The result has been Mitchell's own version of a beach community.

Bald Head lacks the characteristic bright lights, neon signs and high-rise condominiums of a typical resort.

Aside from the glow of two streetlights, the only night light on the island comes from the moon and stars. Neon is taboo, and height is scorned.

Visitors drive electric golf carts because gasoline-powered vehicles are forbidden. And the roads are narrow asphalt paths that wind through the lush canopy of live oaks.

Before Carolina Power & Light Company brought electricity to the island in 1981, homeowners relied on individual generators for their power, prompting early residents to form a Generator Society.

Until recently, the only contact with the mainland was by CB radio. Phone service should be available by 1988, but some residents plan to do without the convenience. The idea, they say, is to get away from it all.

And that's not hard to do on an island whose only connection to the mainland is by private boat or a ferry from Southport run by the developer.

This is Mitchell's first big project, but such developments are nothing new for his family. In addition to building a planned city of 200,000 people outside of Houston, the Mitchells have been active in a push to restore a historic area of Galveston.

When Mitchell took over operations at Bald Head, much of the first stage of development was complete. He inherited an inn, a restaurant, an 18-hole golf course and 40 to 60 townhouses and villas. Some private homes had also been built.

With that stage nearly complete, Mitchell is ready to begin a second stage that will include 600 acres of the eastern portion of the island.

By the time the Bald Head project is complete in 15 years, about 1,600 acres of the 3,000-acre private tract will have been developed.

Although about a third of the first stage was condominiums, about 90 percent of the second stage will be single-family homes. And no high rises, Mitchell says.

"I have a personal aversion to high-rise garbage," he says.

"North Carolina and South Carolina have a tradition of nice beach communities. But in the last 10 to 20 years, you have seen the worst form of Florida, cheap high-rise development. I'm not sure if we can succeed, but I hope we can impart some of the character of a traditional beach community here," Mitchell says.

Strict guidelines mandate not only the size of a house, but also its appearance. Most homes are stained with a natural wood color, and all plans must be drawn by an architect.

Building on Bald Head is strictly regulated

Photo by Nancy Davis

Bulldozing lots is forbidden. Many homes are tucked between the trees, and residents are encouraged to landscape with native plants. Manicured grass lawns are frowned upon.

It isn't easy for the average North Carolinian to appreciate Bald Head.

The residents are one indication of the costs of living there, Mitchell says. He estimates that 25 percent are doctors and 25 percent are lawyers.

Land isn't cheap. Lots average half an acre, but range from quarter-acre parcels to two-acre lots, Mitchell says. And the costs start at $30,000 and go up to $200,000 for a beachfront lot.

And once you buy a lot, you have to consider the cost of building. It is considerably higher than elsewhere on the Tar Heel coast because residents must absorb the cost of transporting materials from the mainland by barge.

Except for the occasional inconvenience of living on a remote island (see story, page 6), property owners are happy with their piece of paradise.

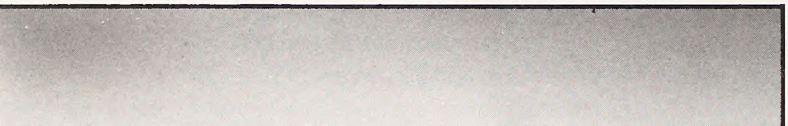
"For those who have found Bald Head, they can't go anywhere else. Nowhere compares to it. It's for a special breed of person," Mitchell says. ■

Preserving a unique environment

BY SARAH FRIDAY

Carol Mayes turned just in time to see an alligator facing her on the other side of the creek. She'd been collecting plants when a sudden splash diverted her attention.

Photo by Scott Taylor



Salt marsh makes up 9,000 acres of the Smith Island complex

Luckily, the reptile had another meal on its mind. The legs of a raccoon were wriggling in its mouth.

Such incidents on Bald Head were rare for Mayes, director of stewardship for the N.C. Nature Conservancy. But the balancing acts of nature continue there everyday.

Now people who want to preserve the wildlife and natural surroundings of Bald Head have become part of another kind of balancing act. Naturalists, developers, homeowners and tourists are weighing the need for change against the need for conservation.

To them, Bald Head's environment is like no other—so different that some people believe it's a mistake.

"South Carolina should have started just north of Bald Head," says Lundie Spence, Sea Grant's marine education specialist. "Bald Head represents a subtropical environment in a temperate state. The obvious evidence for this is palm trees."

Temperatures range from 25 F to 92 F, mirroring the climate of Myrtle Beach. And there's a reason. Bald Head is the northernmost of a chain of islands, the Sea Islands, that lie off the coasts of northern Florida, Georgia and South Carolina.

And since water surrounds Bald Head, the ocean moderates the weather so it's cooler in the summer and warmer in the winter. The nearby Gulf Stream also warms the air.

Bald Head's balmy climate—and a clever entrepreneur—lured tourists to the rustic resort in the 1930s. Before that, the island was a hideout for pirates and a lookout for Civil War troops. And it made fertile ground for pig farms and logging camps.

Years later, the setting is much the same.

A maritime forest, shrub thickets, salt marshes, tidal creeks, ponds and dunes make up the highest quality maritime system remaining in North Carolina, Mayes says.

The combination is a treasure to naturalists such as Mayes. And the crown jewel is the maritime forest.

The thick woodland has survived centuries of salt spray, hurricanes and other harsh oceanic conditions. Today it covers 1,126 acres of the Smith Island complex. The major part of the forest lies behind the dune ridge on Bald Head, but portions also grow on Middle and Bluff islands.

As one of the largest and oldest maritime forests in the state, the woodland stands as evidence of the island's stability. One live oak measuring 17 feet 6 inches around is estimated to be more than 300 years old.

The forest also supports trees and plants from two different regions. Southern species such as the sabal palm grow alongside Northern species such as the live oak.

The thick canopy they create protects the interior of the forest from salt spray and allows other plants to thrive. Loblolly pine, dogwood, wax myrtle and yaupon provide additional cover for the island's abundant wildlife.

It's not unusual to see a gray fox darting in front of your golf cart at night. Or a raccoon munching on berries.

And someone recently reported seeing a bobcat, but island naturalist Bill Brooks is waiting for proof.

Outside the forest, Brooks spends most of his time tracking turtles.

In 1981, naturalists from the Wildlife Resources Commission and the N.C. Heritage Program discovered that Bald Head hosted the state's largest population of nesting loggerhead turtles. They soon realized, however, that 90 percent of the eggs were eaten by foxes and raccoons.

To remedy the problem, naturalists Debbie Crouse and Joe Newman founded the sea turtle conservation project. They devised a wire screen to protect the nests and began monitoring them closely.

Interns from the N.C. Nature Conservancy helped out in the summer, but by 1983 the project had become too big for the inland agency to supervise.

In November, the Bald Head Island property owners' association passed a charter creating the the island's own non-profit conservancy. And they employed a naturalist to keep watch over the loggerheads.

Today 95 percent of the turtle eggs hatch.

Like the beach and the forest, each ecosystem on Bald Head supports a unique collection of plants and animals. Together they seem to form an open-air natural history museum.

Maintaining the museum takes effort.

The developers must build. Buyers and renters want peace and tranquility. Naturalists need to preserve the integrity of the island.

Harmony is sometimes elusive.

During the first stage of building in the 1970s, developers cut down large portions of the maritime forest, weakening the canopy, says Cindy Meekins, board member of the Bald Head Conservancy Inc. and former island naturalist.

Their mistake was evident, Meekins says, when Hurricane Diana swept through Bald Head in 1984 and damaged 70 percent of the forest and most of the golf course fairways.

"It took them months to fix that," Meekins adds.

The current developers, Bald Head Island Limited, took a different approach. After working with conservationists, the group devised a blueprint for construction that left much of the environment intact and did not include another golf course.

They also compiled a 62-page book outlining specific landscaping recommendations and standards for prospective Bald Head residents.

And they contributed 100 percent matching funds to the Bald Head Island Conservancy in its first two years. They still match half of the group's contributions.

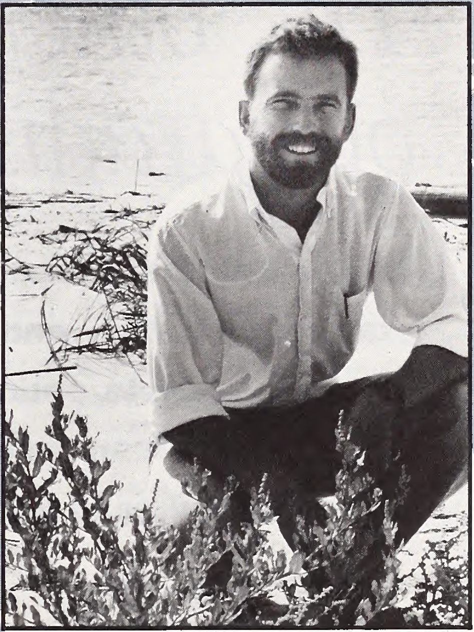
"They want to make sure our efforts succeed," Meekins says. "They realize that if we work together we'll get a lot more done."

So far, so good, according to Brooks.

"Overall, people are happy with how it's been developed," he says. And the effects of building haven't been all bad in regard to plants and animals.

For small animals, development increases habitat, because it creates more diversity around the forest edges, he adds. But for animals that use the deep forest, development decreases living room.

Photo by Sarah Friday



Bald Head Island naturalist Bill Brooks

Saving habitat is one of the conservancy's priorities. The sea turtle project is another. But the group also offers educational programs, landscaping advice, a day camp and nature hikes.

And Brooks hopes that in the next two years the conservancy can expand its role as landscape consultant, helping residents pinpoint important vegetation on their property and relocating any rare or endangered plants.

Homeowners are receptive to the idea, as many share an appreciation for nature. About 250 of the 900 property owners are members of the Bald Head Conservancy.

Like the three-branches of government, the conservancy, the property owners' association and the development organization operate their own informal system of checks and balances. Each appoints members to sit on the boards of the other groups.

The state keeps a watchful eye on Bald Head's unique environment, too. The Museum of Natural Sciences, Zoological Park, Wildlife Resources Commission, Nature Conservancy and divisions of Marine Fisheries and Parks and Recreation monitor many of the natural areas. ■

Photo by Nancy Davis

The other side of paradise

BY NANCY DAVIS

Life on Bald Head Island is everything it's cracked up to be . . . and more. Along with the stunning sunsets, pounding surf and soothing silence come monstrous mosquitoes, hungry alligators and, read carefully, NO BRIDGE.

We're not trying to be negative, mind you. We just want to point out that island life isn't for everybody.

Residents who pay a healthy price for the beauty and serenity of the remote island also get an expensive dose of inconveniences.

And the emphasis is on remote.

There is no bridge from the mainland to Bald Head. Residents say that after a week, they quit worrying about it.

For newcomers, that three-mile span of water makes the island seem as though it's 300 miles from the mainland.

But what if I have to get off of here?

If you have your own boat, it's simple.

If not, you'll have to wait for the ferry. It leaves every hour on the half-hour from the island and on the hour from the mainland. And it's just a 15-minute ride.

But what happens late at night when the ferry stops running and I'm sick and I need to get to the hospital?

The village employs four public safety officers who serve as emergency medical technicians, firemen and police.

If you need to get to a hospital, just pick up your CB and call them. They can have you to the Southport hospital within 28 minutes, says Wallace Martin, village manager.

What's this about CBs? When can I phone home?

Well, phones will be available by the first of the year, but some residents still plan to do without.

There are about five phones on the island now. But they're operated by a microwave system set up in the Bald Head lighthouse. On foggy days or when a tall ship passes, calls are likely to be cut off.

So you'll just have to learn to pick up your CB, good buddy.

Where can I eat on the island?

Your choices are limited. There's one restaurant and one deli.

What about groceries?

There is a small store on the island. And it's even stocked with items such as fresh gourmet coffee beans, a good selection of wines and an assortment of caviar.

But for a week's worth of groceries, you may want to go to the mainland.

Plan your trip carefully. It will require close scrutiny of your remaining rations, a detailed list of next week's meals and plenty of travel time.

Suppose you take the 10:30 a.m. ferry from the island. Depending on where you live, allow yourself extra time to get to the ferry. Remember, only 18 mph in your electric golf cart.

By the time you get to Southport and do your shopping, it will be after noon. You drive back to the dock just in time to reserve your place on the 1 p.m. ferry. Another 15 minutes, and you're back on the island.

What about my ice cream and milk?

If you were smart, you remembered to bring along the cooler. Better yet, just buy your ice cream from the island's store.

I'm not discouraged by those little inconveniences. I'm ready to build my dream vacation home. But where do I get my supplies?

The mainland, of course. All the construction materials have to be shipped to the island by barge.

Everything has to be carefully scheduled so that crews and materials arrive on the island at the same time, Martin says.

"You get the workers over here and find out they need three 2-by-4s," Martin says. "So they're sitting there twiddling their thumbs until the next barge comes."

One contractor estimates that shipping building supplies by barge adds as much as 25 percent to construction bills. ■

THE BACK PAGE

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Christmas is just weeks away. If you haven't finished your shopping, how about a browse through the Sea Grant shelves. We've got a book for just about everyone.

Here's a sampling from our catalog. To ensure delivery by Christmas, send in your order and payment promptly and indicate the publication number.

Seashells Common to North Carolina is one of our most popular publications and sure to please any beachgoer. The 36-page booklet provides detailed descriptions and photographs of shells you're likely to find on Tar Heel beaches. Ask for UNC-SG-72-09. The cost is 75 cents.

If there's a coastal property owner on your list, he'll be sure to enjoy *Seacoast Plants of the Carolinas*. It's a valuable tool for landscaping or just for identifying various plants. Ask for UNC-SG-73-06. The cost is $2.

And how about a copy of *Coastal Capers: A Marine Education Primer?* This 76-page booklet is full of activities for parents and young children. The "capers" are fun and educational. Ask for UNC-SG-84-05. The cost is $3.50.

For sportsmen, Sea Grant has a variety of publications. One of the most popular is a cookbook. *Recipes with a New Catch* contains instructions for handling and preparing 16 species of non-traditional fish. You'll find recipes for shark, triggerfish, bluefish, amberjack and more. Ask for UNC-SG-86-06. The cost is $2.

A Guide to Recreational Shrimping provides tips for rigging small boats for catching the tasty crustaceans. Ask for UNC-SG-86-07. The cost is $4.

When a single clam brings 10 cents to 20 cents at the seafood dealer, coastal folks start talking about raising or culturing the valuable mollusks. People want to know how to handle the young "seed" clams and how to rear their older counterparts in beds, or gardens.

That's why Skip Kemp, a Sea Grant specialist, has set up a clam nursery demonstration site behind the N.C. Aquarium at Pine Knoll Shores. In a cooperative project with the aquarium, Kemp has built a mini-nursery to show prospective clam gardeners different clam rearing techniques.

If you'd like to visit the demonstration site, call Kemp at 919/247-4007.

Kemp also has up-to-date supplier lists for shellfish seed and plastic mesh. The mesh is used to protect the clams from predation once they're put to bed.

And, prospective gardeners may want to mark their calendars for Feb. 6. Sea Grant is cosponsoring an all-day clam grow-out conference at the Duke University Marine Laboratory in Beaufort. Further details about the conference will be announced in the January *Coastwatch*.

Sea Grant is sponsoring a national technical conference on surimi, a minced fish product used in restructured seafoods.

Until recently, most surimi was made from Alaska pollock. But Sea Grant researcher Tyre Lanier has proved that fatty fish, such as menhaden, are also acceptable in making surimi.

The conference, to be held in Raleigh Dec. 10 and 11, will examine the use of fatty fish in surimi. It will attract industry leaders and international experts in surimi research.

Write Sea Grant for more information on the conference.

Sea Grant and the Carteret County Waterman's Association are hosting the eighth annual N.C. Commercial Fishing Show March 12 and 13.

Last year more than 5,000 people attended the boat and gear show in Morehead City. And even more are expected this year for the show that will feature boats, engines, electronics, fishing gear and accessory equipment. Workshops and seminars on fisheries topics also will be offered.

Dealers and manufacturers interested in securing a booth at the show may call Sea Grant agent Bob Hines at 919/247-4007.

Fall is a time for moving south. Wild swans, geese and ducks fly to North Carolina sounds to avoid the bitter northern winter.

But birds aren't the only southbound creatures.

In October and November, migrating fish such as bluefish cruise through North Carolina's coastal waters on a trek to warmer waters.

Schools of bluefish often concentrate at Cape Hatteras. And when bait fish are close to the beaches and conditions are just right, a bluefish blitz is likely.

Lundie Spence, Sea Grant's education specialist, describes a blitz.

"Small bait fish are driven to the water's surface with bluefish slicing through them. Sometimes the small fish are driven onto the beach. Gulls and terns cash in on the blitz as they dive for loose scraps," Spence says.

Word of a blitz travels quickly. Soon a crowd appears, and everyone is casting and reeling in blues.

But Spence urges fishermen not to get so caught up in the action that fish are wasted.

Gut and ice your catch immediately, and freeze what you can't eat in a short time. Because bluefish are oily, their freezer shelf life is only about three months.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Vol. 14, No. 10, November/December 1987. Dr. B.J. Copeland, director. Kathy Hart, editor. Nancy Davis and Sarah Friday, staff writers.

To our readers,

Federal budget cuts are making for tough times in the Sea Grant communications office. Since 1980, our budget has remained the same while inflation has gotten the best of us.

The cost of producing publications—printing, design, mailing—continued to increase and buying power decreased.

But we scrimped and saved and continued to send more than 18,000 of you a free *Coastwatch* at a cost of about $4,500 each month.

With no extra funding to meet these increases, Sea Grant is faced with some tough decisions. We are considering cutting *Coastwatch* from 10 issues a year to five and eliminating the newsletters produced by the Marine Advisory Service agents and specialists. That includes *Conchshell*, *MAS News* and *Legal Tides*.

Many of you have told us how much you appreciate *Coastwatch* and look forward to its arrival each month. We'd like to continue to provide you with this informative newsletter 10 times a year, but we can't without some extra dollars.

If you'd like to help the program with its publishing plight, we'll thankfully accept contributions. Send your tax-deductible donation to Sea Grant Communications, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Please make checks payable to North Carolina State University.

Thank you,

Kathy Hart
The Editor

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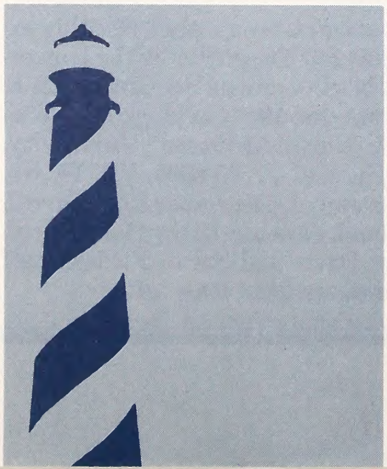

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COASTWATCH

The heat is on

- The greenhouse effect
- Rising seas
- The North Carolina perspective

The greenhouse effect: Is it here?

BY NANCY DAVIS

Imagine the Earth as a giant laboratory.

In the past century, we've been conducting an experiment in our laboratory. We've burned massive amounts of coal and oil and pumped all the byproducts into the sky.

We called our experiment the Industrial Revolution.

Now, the results of our revolutionary investigation are just coming in.

And as it turns out, the advances that ushered us into the modern age may have changed the world for mankind to come.

Consider the evidence:

- This year, 30 states had the driest spring in 50 years.
- This summer, the Midwest suffered through what may have been its worst drought since the dust bowl of 1934.
- The Earth's temperatures for the first five months of 1988 were the warmest on record.
- And if that's not enough, the four hottest years of the last century have been in the 1980s.

Could it be that the dreaded greenhouse effect is here?

Some scientists believe the evidence is mounting. Others are more cautious, suggesting the record heat may just be an aberration of weather patterns.

But they agree that if the greenhouse effect isn't already here, the record heat we're sweltering through now is probably a preview of things to come.

"The frightening thing is that 1988 is already known to be the hottest year in the recorded history of the earth," says Len Pietrafesa, a Sea Grant researcher and physical oceanographer at North Carolina State University. "This is a global phenomenon. You just can't ignore that."

The theory behind the greenhouse effect is simple.

Since the Industrial Revolution, the use of fossil fuels such as coal and oil, has dramatically increased the amount of carbon dioxide in the atmosphere.

Add to that other pollutants, such as methane, nitrous oxide and chlorofluorocarbons. The result is a collection of gases that blanket the Earth.

To make matters worse, we've chopped down much of the world's forests. And that just compounds the problem since plants help reduce the amount of carbon dioxide through photosynthesis.

The price we must pay for our automobiles, airplanes and smokestacks is life in a more intense greenhouse.

Under normal conditions, the rays of the sun warm the Earth, and Earth reradiates heat to the atmosphere. But some of the heat is retained in an opaque ceiling of gases around the globe. The ceiling acts as the glass roof of a greenhouse.

But the additional gases that we've dumped into the atmosphere are creating an even thicker ceiling of gases around us, trapping more heat in and allowing less heat to escape. Thus the greenhouse is getting hotter than it would otherwise.

The extreme example of the blanketing effect of carbon dioxide is Venus. With an atmosphere of 97 percent carbon dioxide, the planet absorbs 100 times the heat Earth absorbs.

Nobody expects the Earth to become another Venus. But according to estimates from the National Academy of Sciences, if the gases continue to build up around the Earth, we can expect a warming of 3 to 9 degrees Fahrenheit by the year 2050.

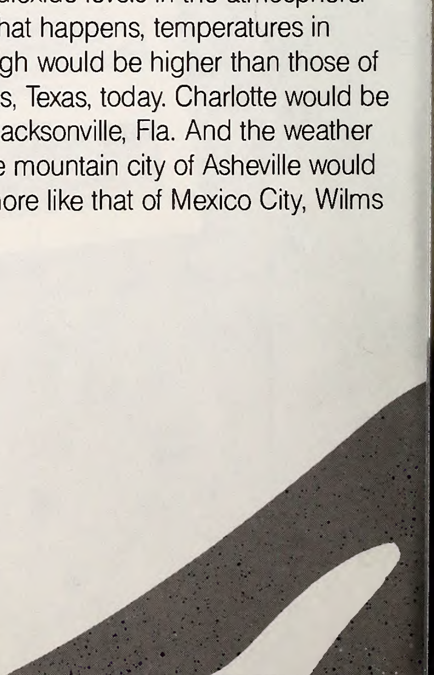
In testimony to a congressional committee, James E. Hansen of the National Aeronautics and Space Administration, said he was 99 percent certain that the current warming trend was caused by the buildup of gases in the atmosphere. Hansen is director of NASA's Institute for Space Studies.

If the greenhouse effect does take over, we can expect big changes.

The country's midsection will all but dry up. And the nation's breadbasket will shift north. Canada will become the biggest food producer in the world.

And the greenhouse effect will hit close to home. Paul Wilms, director of the N.C. Division of Environmental Management, predicts that by the year 2030, there will be a doubling of carbon dioxide levels in the atmosphere.

If that happens, temperatures in Raleigh would be higher than those of Dallas, Texas, today. Charlotte would be like Jacksonville, Fla. And the weather in the mountain city of Asheville would be more like that of Mexico City, Wilms



says in a paper he presented at a symposium in May.

And the Tar Heel coast? Well, it just won't be the same.

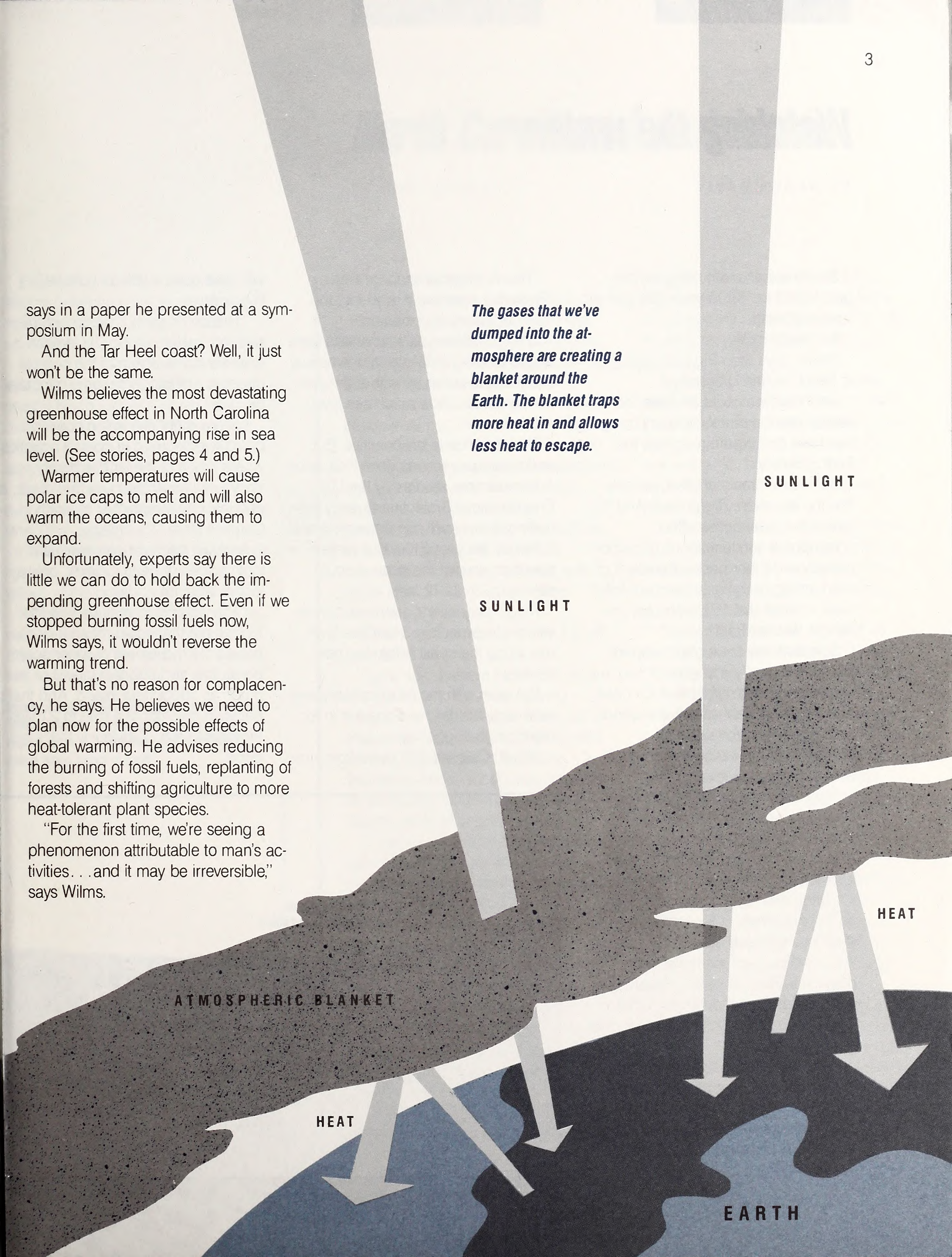
Wilms believes the most devastating greenhouse effect in North Carolina will be the accompanying rise in sea level. (See stories, pages 4 and 5.)

Warmer temperatures will cause polar ice caps to melt and will also warm the oceans, causing them to expand.

Unfortunately, experts say there is little we can do to hold back the impending greenhouse effect. Even if we stopped burning fossil fuels now, Wilms says, it wouldn't reverse the warming trend.

But that's no reason for complacency, he says. He believes we need to plan now for the possible effects of global warming. He advises reducing the burning of fossil fuels, replanting of forests and shifting agriculture to more heat-tolerant plant species.

"For the first time, we're seeing a phenomenon attributable to man's activities. . .and it may be irreversible," says Wilms.



The gases that we've dumped into the atmosphere are creating a blanket around the Earth. The blanket traps more heat in and allows less heat to escape.

Watching the water

BY NANCY DAVIS

Sea level has been rising for the past 17,000 to 18,000 years. It's part of a natural trend.

So what's new?

Plenty, says Stan Riggs, a geologist at East Carolina University.

Until now, we could attribute the steady rise to normal climatic changes that have occurred throughout the Earth's history.

But we've thrown another variable into the equation, Riggs says. And it's called the greenhouse effect.

Increased concentrations of carbon dioxide and other gases, the result of our burning massive amounts of fossil fuels over the last 150 years, are creating a warmer Earth.

Scientists say the higher temperatures, even if only a degree or two, will cause more melting of polar ice caps. And, as the ocean warms, it expands, causing an additional rise.

The result is an acceleration of an already rising sea level.

Riggs says the oceans have been rising at a rate of about one-half to three-quarters of a foot per century. And in the history of the world, sea level fluctuations are nothing unusual.

During one ice age, sea level was so low that much of the continental shelf was exposed. In warmer times, the polar ice caps melted and the oceans swelled. For example, about 5 million years ago the Atlantic Ocean reached slightly west of Wilson, Riggs says.

But the greenhouse effect adds a man-made twist to a natural phenomenon. So far, Riggs is hesitant to say whether we're already seeing a rise in sea level because of the greenhouse effect.

"This is all projection," he says. "From this point on, it goes into the realm of theory and models."

In the past few years, scientists have begun feeding data into mathematical equations to come up with estimates of if, when and how much sea level will rise.

Their science is still primitive. But preliminary projections don't look good.

For example, studies by the U.S. Environmental Protection Agency estimate that seas will rise between 4 and 7 feet by the year 2100. But some scientists predict the oceans could rise as much as 12 feet.

Riggs' projections are more conservative. He expects a 3-foot sea level rise along the coast within the next century.

But even with the most conservative estimates, the Tar Heel coast is in for big change, Riggs says.

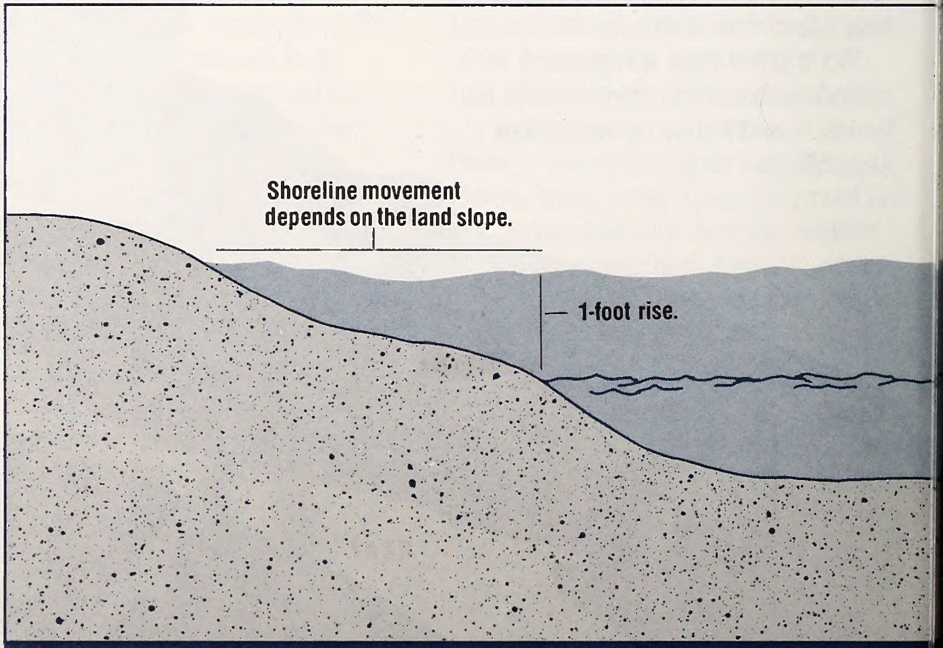
"North Carolina 400 years from now will have quite a different shape," Riggs says.

"This could have a significant impact on a state like North Carolina where a half a dozen of the coastal counties are just as flat as a pancake," he says.

Even a slight rise in the oceans could wreak havoc in coastal counties where much of the land is barely above sea level, says Len Pietrafesa, a physical oceanographer at North Carolina State University.

And just because sea level rises a foot, it doesn't mean it claims only a foot of land, he adds.

"The water level may be one foot higher, but that could mean in some places the movement of water could be as little as 1,000 feet inland or as much as 10,000 feet inland. And that's between one-fifth of a mile to 2 miles," Pietrafesa says. "Obviously that's not good."



Paul Wilms, director of the N.C. Division of Environmental Management, has done some figuring to find out what might happen to coastal Carolina.

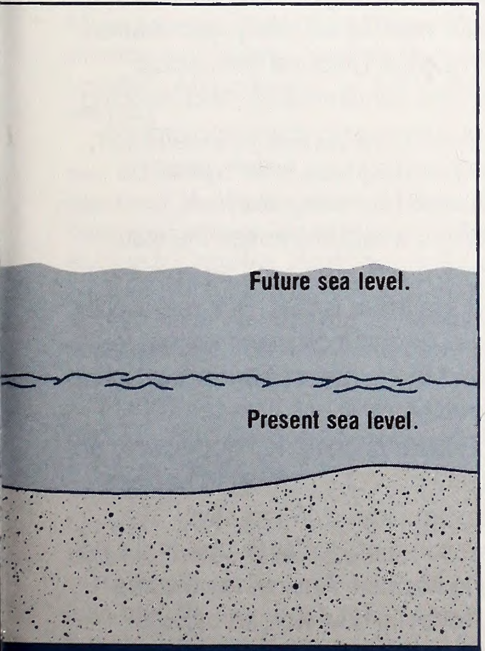
Using a 5-foot sea level rise as an example, he says 1.23 million acres in coastal North Carolina would be inundated, ranging from 6,000 acres in Chowan County to more than 260,000 acres in Hyde County.

Such a rise would disrupt nearly every aspect of life there, he says. (See story, this page.)

"This is an issue that can create mass hysteria," Pietrafesa says. "Property values at the coast could plummet."

Whether we'll see such changes in our lifetimes is anybody's guess, Pietrafesa says. He adds, "I'm a scientist. I never say I know until I really know."

Much of coastal Carolina is barely above sea level. Because of the gentle slope of the region, even a 1-foot sea level rise could claim many acres of land



North Carolina: A look ahead

BY SARAH FRIDAY

Armor or retreat.

That's the choice people eventually will have to make at the coast if sea level rise continues, says Paul Wilms, director of North Carolina's Division of Environmental Management.

While scientists battle out the "when" of sea level rise, Wilms is studying the "where and how" for North Carolina.

He is part of a small clan of researchers and authorities who foresee major decisions for the state if the greenhouse theory becomes fact. As sea level rises, North Carolina's coastal farms, homes, bridges, wetlands and drinking water will be devastated, they say.

Others want to wait and see if it will happen at all.

Right now, eastern North Carolina lies like a long, flat road curving around the water's edge. The road makes up 320 miles of coastline and at least 3,000 miles of estuarine shoreline. And in 22 coastal counties, its elevations range from 100 feet above sea level to only a few feet.

If warming trends continue, Wilms estimates that 1.2 million acres of lowlands, swamps and marsh in North Carolina would be flooded with a 5-foot rise in sea level. Much more would be impacted.

Six counties at the coast would be hit the hardest, Wilms says. Three-fourths of the flooding would occur in Hyde (21 percent), Dare (17.5), Tyrrell (15.1), Carteret (7.5), Currituck (6.8) and Pamlico (4.8) counties.

There's no doubt sea level rise could cause significant environmental, economic and social impacts in North Carolina, Wilms says.

The environmental impacts of sea level rise are not bad, Wilms says. Nature has a way of bouncing back and adjusting to the changes. But the impacts on people pack a stronger punch.

As sea level inches up the back steps of an oceanfront home or fills in the pool of a beachside condominium complex, people will demand expensive sea walls, bulkheads, beach nourishment and other measures to save their investments.

"I'm convinced that the environmental impacts of mankind's response to sea level rise will be worse than the ecological impacts of the phenomenon itself," Wilms says.

"Vested interests will demand we have protectionist strategies," he says. "People who have built will demand it."

Eventually, each community must choose whether to build structures to hold back the sea or to retreat, Wilms says. Most likely they'll opt for protection in the short-term, he says, but they should have a long-term strategy to move back.

To Wilms, retreat is the only long-term solution.

His numbers suggest that 282,000 permanent residents in 18 of the 22 coastal counties would have to move if a 5-foot rise in sea level occurred. That's about 44 percent of the 1986 population for those counties.

Webb Fuller, Nags Head town manager, knows of the greenhouse theory and is aware of its possibilities, but he hasn't pulled out his bullhorn yet.

"Yes we're concerned about it." Yet, he adds, "There are a lot more pressing issues than to worry about some-

continued on next page

A look ahead continued

thing that *may* happen in 2030."

"We're not doing anything about it. I don't think we can realistically do anything yet," Fuller says. "When we see more erosion, houses falling in, and more concrete research with rising sea level—it will then become an issue in the forefront."

Until then, we wait and speculate.

Along with flooding, expect the barrier islands to move west, and beach erosion and saltwater intrusion to increase, Wilms says. He figures 500 to 5,000 feet of beach would erode in North Carolina with the 5-foot rise.

Spencer Rogers anticipates other problems, too, with sea level rise.

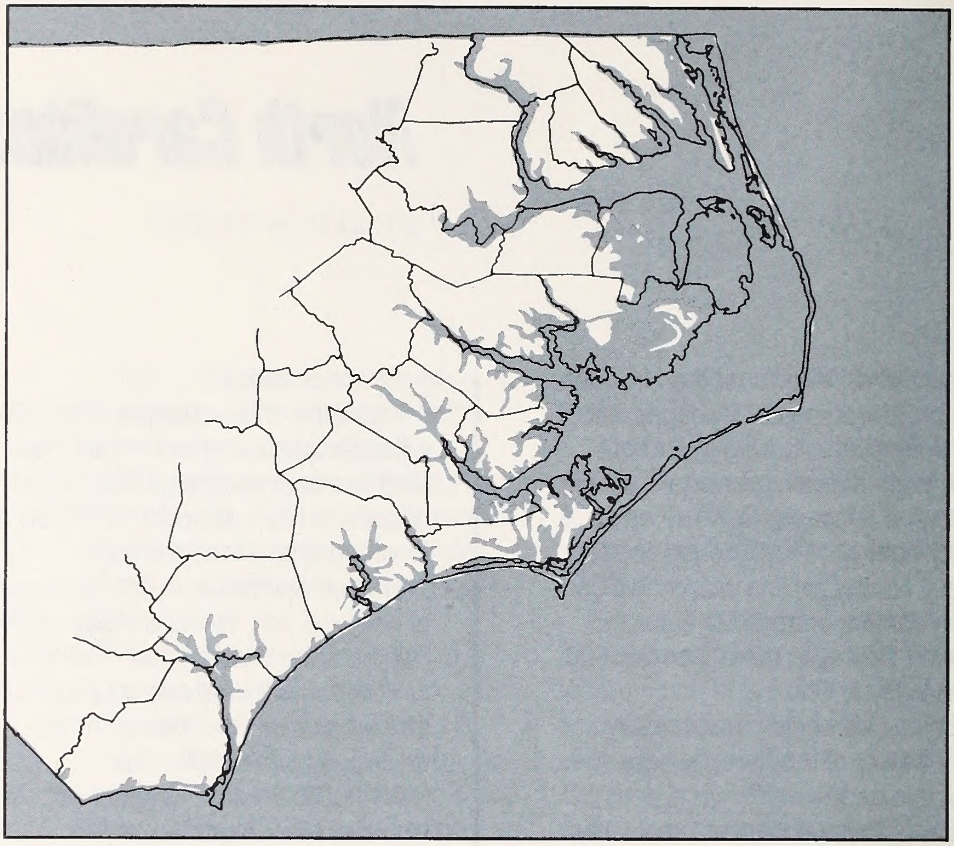
"One of the concerns is the effect on wetlands," says Sea Grant's coastal engineer. "Pamlico and Albemarle sound wetlands are seeing some of the highest erosion. As sea level rises, the wetlands will move into higher grounds. The area of the wetlands will go down," he adds.

With saltwater intrusion, the mixing zone—where the ocean and river meet—moves up the river. This could affect areas where communities draw fresh water and could change surface and groundwater levels, Rogers says. Plants and aquatic life accustomed to fresh water would likely be wiped out when the salt water moved in, he adds.

And it could mean a loss of thousands of acres of eastern North Carolina farmland.

Hyde County farmers have been battling the sea for decades. But in the past few years, an increasing portion of the county's farmland has been lost to saltwater intrusion.

About 60 to 70 percent of the county's farmers use tide gates or dikes to block salt water from flowing into ditches that drain most of their fields, says Daniel E. Smith, Hyde County's extension director. Without the gates, about half of the land would be useless.



Projected change in North Carolina's shoreline with a 5-foot rise in sea level

J.W. Spencer hesitates to blame the intrusion on the greenhouse effect. But like other Hyde County farmers, he can't deny sea level is rising.

"This greenhouse effect—if that's Mother Nature's course, you can't stop it," Spencer says. "You can slow it down, but you can't stop it."

But he adds, "Who's to say that the trend won't change. We can't predict it. Weathermen have a hard time predicting the weather one day to the next."

Fishermen, too, are watching the water. Wilms estimates that 65 percent of North Carolina's primary nursery areas will be lost with a 5-foot rise in sea level. Commercial fishing would be out, he says, but the industry may come back as new estuaries form.

Already, researchers in New Hanover County suspect sea level rise as a culprit in the death of gum and cypress trees along the northeast portion of the Cape Fear River.

One landowner there has watched tree after tree die as salt water pushes up the river. Researchers from the University of North Carolina at Wilmington and a team of specialists found that high salinity in the intrusive waters was the killer.

With the rise, sewage sytems, wastewater treatment plants, buildings, roadways, bridges, wharves and piers would need to be totally restructured, Wilms says. Disposal sites would become contaminated. And leeching of pollutants and toxics into groundwater and surface water would be enhanced by rising sea level.

Wilms would like to see the state devise a policy as soon as possible to address these issues. But, realistically, he knows that politicians will not respond to the greenhouse effect until it is imminent.

"Retreat is going to happen with an orderly plan or it's going to happen catastrophically," Wilms says. "We have some say today in how that's going to happen. And we have some say today in how we can provide short-term protection."

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

The best deals in coastal real estate are not always the ones with the lowest price tags.

Most often, the best deals involve buyers and sellers who are informed of the risks, costs and regulations of owning coastal property.

To help buyers, sellers, developers and others weave through the maze of considerations, four state organizations will sponsor a series of workshops this fall.

Coastal Property Workshop: Planning, Constructing and Selling Barrier Island Real Estate will be held in four locations during September and October. (Details follow) It is sponsored by Sea Grant, N.C. Division of Coastal Management, N.C. Real Estate Commission and North Carolina State University's Department of Civil Engineering.

The all-day programs will help anyone interested in coastal property understand the environmental hazards, costs and ownership options involved in North Carolina. And they will take an in-depth look at the regulations that apply, such as building code standards, permit and condominium and time-share requirements.

Workshops will be held: Sept. 16, Raleigh, McKimmon Center; Sept. 30, Kill Devil Hills, Ramada Inn; Oct. 14, Morehead City, Crystal Coast Civic Center; and Oct. 21, Wrightsville Beach, The Blockade Runner.

Registration for each workshop begins at 7:30 a.m. Each runs from 8:30 a.m. to 5:30 p.m. The registration fee is $18 and is due one week before each workshop. Late registrants must pay an additional $5. The fee includes lunch, refreshments and workshop materials.

To register, call or write Brenda Miller, Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605. The number is 919/737-2454.

Sea Grant has published two more brochures in its seafood series. **Cracking into Crustaceans** (UNC-SG-88-01) provides illustrated instructions for cleaning shrimp, hard crabs and soft crabs. And **Breaking into Bivalves** (UNC-SG-88-02) gives illustrated methods for shucking oysters, clams and scallops.

The brochures were developed by Joyce Taylor, Sea Grant's seafood education specialist. Other brochures in the series include: **Hooked on Fresh Fish and Shellfish** (UNC-SG-85-08), which tells consumers how to choose fresh seafood; **Bringing the Catch Home** (UNC-SG-86-26), a guide for handling, preparing, transporting and storing fresh fish; **Dressing Finfish** (UNC-SG-86-10), an illustrated guide to cleaning the catch; and **Flaking Fish** (UNC-SG-87-05), which describes how to flake fish for use in other seafood dishes.

Each brochure is 50 cents. To order, write Sea Grant. Be sure to include the publication number for the brochures you are ordering.

Folks in Washington, D.C., feasted on fresh North Carolina seafood in May at the annual "Taste of the South."

The seafood, which was donated by the North Carolina seafood industry, was prepared by Joyce Taylor, Sea Grant's seafood education specialist. Jerry Schill, executive director for the N.C. Fisheries Association, presented the tasty treats to about 1,500 Capitol Hill staff members and young professionals with ties to Dixie.

At the Tar Heel table, they sampled North Carolina shrimp, crab claws, a seafood salad and a smoked fish spread.

Taste of the South is a fund-raiser for charities. This year, $25,000 was raised for The Lighthouse, a Louisiana-based educational enrichment center with a chapter in Charlotte.

If you fish in the state's northern coastal waters, Rich Novak could use your help. Novak, Sea Grant's marine recreation specialist, is working with the N.C. Division of Marine Fisheries to install a series of miniature artificial reefs in the waters off Oregon Inlet. And he wants recreational fishermen to let him know how they are working.

The reefs, called fish aggregating devices, are suspended in the water and serve to attract fish. They are installed in a series to form a trolling alley for recreational fishermen.

Novak will place one series of the devices about 7 miles southeast of Oregon Inlet. He believes that reef will attract king and Spanish mackerel.

Another series of the devices will be located about 35 miles southeast of Oregon Inlet. He believes that the reefs will attract king and Spanish mackerel.

If you're planning to fish in the area, Novak will trade you directions to the reefs for your catch data. Call him at 919/473-3937.

Discover the best of the beach at the fall conservation retreat sponsored by the N.C. Wildlife Federation Oct. 6 to 9.

The weekend retreat in Atlantic Beach combines fun activities with educational programs for adults and children. Learn to surfcast for a sea trout, grill a grouper or marvel at a marsh. Or listen to tales of folklore or a talk on coastal land management.

Classes will be held in the morning. Afternoons are free, then evenings

Continued on next page

offer stargazing, free time or social activities.

Field trips such as an offshore cruise or a trip to the N.C. Aquarium will also be available.

Group rates are $55 for doubles; $50, single at the Holiday Inn in Atlantic Beach. For reservations, call 919/726-2544. For more information on the retreat, write the Wildlife Federation at P.O. Box 10626, Raleigh, N.C. 27605. Or call 919/833-1923.

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Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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I am in the following line of work:

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__Commercial fishing
__Educator
__Farming
__Homemaker
__Lawyer
__Marina operator
__Marine recreation
__Mass media
__Seafood processing/marketing
__State government
__University professor/researcher
__Other ____________________

Coastal property owner __yes __no Boat owner __yes __no

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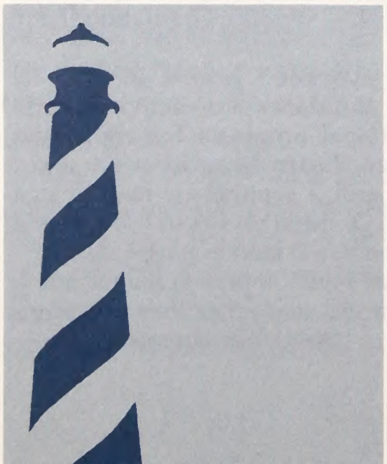

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COASTWATCH

BEACH SWEEP '88
Coastwide Cleanup
September 24th

Photos by Scott Taylor

Keeping The Coast Clear

BY KATHY HART

It was a perfect mid-September Saturday. The orb overhead was shining brightly, and highs were predicted in the 90s. Two friends and I were rolling down the highway toward Wrightsville Beach.

In another 30 minutes, we'd be there. Then it would be time.

Time to roll out the beach blanket, slather on the suntan lotion and catch the rays, right?

Not exactly.

Our plan called for rubbing on the sunscreen, pulling on a gardening glove and picking up a trash bag. It was finally time for Beach Sweep '87.

We'd been planning it for months.

Lundie Spence, a Beach Sweep coordinator and Sea Grant's marine education specialist, had checked everything twice to make sure North Carolina's largest beach cleanup was organized and ready.

But she need not have worried. A lot of people had pitched in before the first piece of trash was picked up.

The four coordinating agencies—Sea Grant, the N.C. Aquariums/Office of Marine Affairs, the Division of Coastal Management and the Division of Parks and Recreation—had donated countless hours of staff time and paid printing costs for posters, press kits, data cards, volunteer stickers and certificates.

Waste Management Co. and the N.C. Department of Transportation supplied trash bags. And Southern Golf Distributors made sure every volunteer had a pencil to record the litter.

All that was needed now were trash gatherers.

If everyone could have just seen the photographs I had, they would have had no trouble getting themselves out of bed for a few hours of cleanup.

We had pictures of birds that had starved to death because they were tangled in fishing line, fish whose bodies were nearly cut in half by six-pack yokes and sea turtles that had gagged to death on plastic bags.

For me, a lover of all lesser creatures, the photographs were heart-wrenching. The message was clear: Litter kills.

And if the message was clear, so was the solution. Pick up the trash.

So when we arrived at Wrightsville Beach, I was ready to bag it.

The first zone captain we checked with said he had plenty of volunteers—a class from the University of North Carolina at Wilmington and several families. He suggested we go to the south end of the beach and catch a boat to Masonboro Island.

As we got back in the car, I was disappointed. How much trash can there be on an uninhabited island? I wanted to make an impact. I wanted to bag lots of debris.

A volunteer with a boat ferried us over to the island. We took a data card, a pencil and three 30-gallon trash bags apiece and headed across the dunes for the beach.

There, we saw groups of trash collectors to the south and north. We opted for the southern route.

We walked close to the dune line, noticing that the group ahead had fanned out close to the water's edge. We could pick up the few things they missed.

We had not taken more than five steps, when friend and fellow Sea Grant communicator Nancy Davis found the first plastic drink bottle. And just a few feet ahead of that was a partially buried Styrofoam cup.

And so it began. For the first hour, Judy Hunter, our other companion, acted as recording secretary, noting each piece of litter on the data card.

"Piece of glass," I yell as I stoop to pick up the broken shard.

"Can," Nancy follows.

"Egg carton," I say.

Judy calls us to a momentary halt. We're picking up litter faster than she can mark the trashy finds on the card.

Soon we caught up with the group ahead. By then, Nancy and I had each collected a bag of trash.

The group was heading back. They were out of bags. Along just a half mile of uninhabited beach, 12 collectors had amassed 25 to 30 bags of trash. It certainly didn't speak well for people who use the remote island's beaches and offshore waters.

We moved ahead. Nancy took over recording duties, and Judy became trash collector. Now that we were sweeping uncleaned beach, the amount of trash increased drastically.

A shoe.

Pieces of glass.

A truck tire so big we couldn't get it out of the sand.

Large plastic soda bottles, 30 or more.

Drink cans, 15 to 20.

Plastic bags.

Styrofoam pieces, more than 50.

Matted fishing line.

Twisted pieces of metal.

Another quarter of a mile and our bags were full. It was time to turn back.

Yet, down the beach at the base of the dunes, I could see at least five more soda bottles. I wanted to pick them up because with each can and bottle I stuffed into my trash bag I became more intent on picking up the next.

But our bags were full and heavy. We were worried we wouldn't be able to carry what we had collected back to the rendezvous point. Faced with reality, we turned our backs on several more miles of littered beach.

I was angry.

The coastal waters I had written about for eight years, the waters that cooled us on a hot summer day and yielded delicious offerings of shrimp, crabs and fish were being used as garbage disposals. People were carelessly tossing their refuse aside.

I wanted to find every person who had left his litter to linger and ask, "Why didn't you pack it back?"

Unfortunately trash doesn't bear the name of its user. But it does provide clues. From the looks of our litter, we had a good idea that our culprits were picnickers, sunbathers, boaters and recreational anglers.

One hour and a boat ride later, we were back at Wrightsville Beach talking to regional Beach Sweep coordinator Andy Wood. He was busy collecting data cards so the trash could be tabulated.

Several weeks later the results were in and reported to the media. More than 1,000 volunteers had bagged 14 tons of trash along 150 miles of beach.

The tonnage included 33,375 plastic items, 18,597 Styrofoam pieces and 13,448 metal objects. Paper products amounted to 10,090, glass bottles and shards to 7,971, wooden objects to 3,372 and rubber toys and tires to 787.

Volunteers and organizers rated the event a success and began planning for the next year. Meanwhile, Beach Sweep coordinators accepted a national Take Pride in America award at the White House.

But it's not awards or publicity that make Beach Sweep a success. It's changing the attitudes and actions of people who use our beaches and coastal waters that makes a difference.

I know a walk along the beach will never be the same for me again. Now, instead of collecting shells or driftwood, I collect trash.

(For details on this year's Beach Sweep, see page 5.)

Plastics—Breaking Up Is Hard To Do

BY SARAH FRIDAY

It's just like an old Western standoff.

On one end of town are the world's plastic producers. On the other end, environmentalists.

Plastic producers manufacture the materials that make our bottles unbreakable and our panty hose more durable.

Environmentalists say we're paying a price for this convenience in the lost lives of marine wildlife and the pileup of trash.

Some dust flies, but there's no real shooting yet. And each claims to be wearing the white hat.

Plastic, from packaging to paint to polyester, has changed our lives since its genesis in the 1930s. Now it's an explosive $15 billion a year industry.

The sturdy, yet flexible miracle material is chemically engineered to last. Most of the 200 forms of plastic can endure up to 450 years, scientists say.

So the plastics we throw away don't go away. They stay buried in landfills, locked in plastic bags and heaped in our oceans.

Environmentalists are worried.

At least 70,000 tons of plastic debris are dumped or lost each year in the world's oceans, estimates the National Academy of Sciences. Worldwide, the trash contributes to the death of thousands of sea turtles, birds, seals and fish each year.

The durability of plastic has caused problems on beaches, in waterways and in landfills.

Now environmentalists and lawmakers want plastic producers to meet them halfway. The solution, it seems, is degradable plastic.

Their targets include mostly manufacturers of discarded plastics such as fast-food containers, six-pack rings, diapers and tampon applicators.

U.S. companies such as Dow Chemical Co. and Exxon Corp. are pouring millions of dollars into new technologies for degradable goods. And companies such as Webster Industries, which produces plastic bags, and Illinois Tool Works, a six-pack ring manufacturer, have had degradable products on the market since the 1970s.

Some in the industry scoff the move, saying "the quest for plastics degradability is a fantasy driven more by political pressure than common sense," according to an article in *Modern Plastics* magazine.

They are worried the anti-plastic movement could send packagers and consumers back to paper, glass and aluminum goods. And they favor more research of other choices such as improved landfill, incineration and recycling techniques.

Degradable plastics are more expensive to make, says Richard D. Gilbert, a professor of textile chemistry at North Carolina State University who has researched biodegradability. Industries can count on a 15 percent increase in costs, which will eventually be passed on to consumers.

In addition, the time some of these plastics can be used will be limited, Gilbert says.

And that's not good if you're a store-owner who sets six-packs of sodas outside your store, for example. Depending on the makeup, photodegradable rings could deteriorate before someone buys the drinks.

All plastics are photodegradable to some extent, but the process is very slow, says Vivian T. Stannett, a professor emeritus in the NCSU Department of Chemical Engineering.

What scientists seek now are ways to greatly speed this process.

Conventional plastics are made of synthetic polymers—long chains of molecules of the same chemical unit.

Think of it as a beaded necklace, Stannett suggests.

A natural polymer such as sugar is small and does not have many "beads." But polymers for plastics can contain up to 10,000 molecules, Stannett says.

The long chains contribute to the plastics' high strength, flexibility and toughness, Gilbert says. And these properties allow them to be used in hundreds of ways.

Plastics used in textiles, say, are different from those in latex paint. Acrylic differs from the plastic in a Styrofoam cup.

To make plastics degradable, the chemical bonds that hold the beads together must be sensitive to light, oxidation, other chemicals, bacteria or enzymes.

In 1976, Webster Industries began adding a chemical to raw plastic resins to produce a line of degradable garbage bags, says Doug Klem, a regional sales manager in Charlotte, N.C. All it takes is a few hours of sun to start the process.

When ultraviolet light strikes the photosensitive bonds in the long polymer chain, it breaks the bonds and divides the molecules into shorter and shorter chains. Eventually, you can bury the bag, and it will shred to almost nothing.

The time it takes to disappear varies, Klem says. Variables include the time of year, temperature and the amount of available ultraviolet light.

In Raleigh, N.C., a bag might take one and a half years to two years to decay, Klem says. In Maine, it would take about five years.

To make plastics biodegradable, a natural or synthetic polymer must be added to the long chains that can be eaten by bacteria and enzymes. Starch and cellulose are two natural polymers often added.

One Illinois industry added cornstarch to a plastics mixture to create such a bag. Once the bag is buried, the cornstarch becomes food for the bacteria and other microbes in the soil. As they eat the "bonds," the long chains become smaller. The more cornstarch used, the faster the bags degrade.

Although salespeople agree the market for degradables is small now, they expect to see an increase as people become more environmentally aware and more legislation is passed.

New state laws requiring degradable six-pack rings haven't hurt business for the Hi-Cone Division of Illinois Tool Works. They make a photodegradable ring that can rot in two to 15 weeks, depending on the sunlight.

Although such degradable items could alleviate problems for wildlife in the long-term, they can still be harmful in the short-term.

After all, even one month is too long for a brown pelican to escape a tangled mesh of discarded fishing line.

Litter Laws

BY NANCY DAVIS

You've just drained the last few drops of a diet soda. And you figure it'll be OK to casually drop the plastic drink bottle to the sand.

No one will see, right?

WRONG.

You've been caught. A concerned citizen sweeps down on you with all the zeal of Gomer Pyle yelling "Citizen's arrest! Citizen's arrest!"

How dare you trash his beach? How dare you endanger the lives of marine wildlife? How dare you?

You don't have to live in Andy Griffith's Mayberry to get turned in for breaking the law.

All it takes is a soft drink bottle, a cigarette butt or a plastic sandwich bag carelessly tossed aside. You've broken the law, and now you have to pay.

In North Carolina, littering is a crime whether you're on the highway, the beach or the water, says Donna Moffitt, assistant director for the N.C. Office of Marine Affairs and an attorney.

The state's litter laws are twofold, she says.

The criminal statute makes littering a misdemeanor punishable by a fine of $50 to $200 for the first offense or a term of community service.

The water safety statutes prohibit littering of waters. The maximum fine is $250.

Both laws are enforced by law enforcement officers and wildife protectors.

Moffitt says officers are more likely to cite beachgoers for littering if they see the violation. But officers will also take the word of a witness.

Even so, few folks are bold enough to confront a litterbug with his crime. If an officer is nearby, you can point the offender out to him, she says.

If not, you may have to play detective. Follow the litterbug to his car and get his license plate number. A description of the person is also helpful. Then call the local police department and report the crime.

If the violator doesn't admit his crime, you may have to go to court to help prove the case, Moffitt says.

Once an offender is found guilty, the judge may order the person to pay a fine or to perform a community service.

Moffitt would like to see more offenders sentenced to clean up the beaches that they helped trash.

To encourage that, she sent a letter to all district attorneys with coastal counties in their jurisdiction, encouraging them to ask for sentences to make litterbugs pick up trash as their punishment.

Law officials in coastal counties say littering is a minor offense compared to some of the crimes they encounter, but that doesn't stop them from issuing citations.

Police Chief William R. Duke, of the Atlantic Beach Police Department, estimates his force hands out about 25 citations for littering each month.

But his officers encounter many more offenders than that.

Sergeant Alan K. Miller of the Atlantic Beach squad usually gives offenders a tongue lashing. If they're cooperative and offer to pick up their litter, he'll let them go.

But not everyone is cooperative. "A lot of times, they act surprised when I approach them," he says. "They'll know they violated the law, but they don't see anything wrong with it."

Miller sets them straight by issuing a citation.

With more frequent reports of sunbathers being injured and wildlife being harmed, Police Chief Duke predicts his officers will crack down even harder.

The U.S. government is also getting tough on litterbugs.

Last year Congress ratified an amendment to the MARPOL Treaty (marine pollution), making it illegal for ships and boats to dump plastics in the ocean. The treaty, which goes into effect at the end of this year, will be enforced by the Coast Guard.

The beauty of the amendment, Moffitt says, is that "it applies to all boats, no matter what size, from the very smallest fishing boat all the way up to the supertankers."

The states are cracking down, too. More than a dozen states have passed laws requiring that plastic six-pack yokes be photo- or biodegradable. North Carolina officials are considering introducing a similar bill to the legislature next year.

Some localities have gone even further. Suffolk County on Long Island passed a law forbidding retail food establishments to use plastic grocery bags, food containers and wrappers beginning next year, according to a report in *Newsweek*.

But despite all the legislation passed, cleaning up the coast ultimately lies in the hands of the individual. So remember, if you see someone littering, don't be afraid to yell, "Citizen's arrest."

Beach Sweep '88

Do your part to keep our coast clean. Join us for Beach Sweep '88, Sept. 24 from 9 a.m. to 1 p.m.

To volunteer, call the coordinator for your favorite beach. If your beach isn't listed, contact the regional coordinator.

We'll supply the trash bags. You bring shoes, a pair of gloves, a hat and some sunscreen.

See you on the 24th.

Beach Sweep '88 Zones and Zone Captains

Northern Region: Duck to Ocracoke
Regional Coordinators: Rich Novak (919/473-3937)

Duck to Southern Shores: Rex Peters (919/261-8148)
Kill Devil Hills: Tommy Zincome (919/473-2161)
Nags Head: Bob Oaks (919/441-8274)
Oregon Inlet to Hatteras: Al Stein (919/995-5059)
Pea Island Wildlife Refuge: Bonnie Strauser (919/473-1131)
Cape Hatteras to Frisco: Shay Clanton (919/986-2279)
Cape Hatteras National Seashore: Tom Hartman (919/473-2111)
Ocracoke: Howard Bennick (919/928-1981)

Central Region: Cape Lookout National Seashore to Swansboro
Regional Coordinator: Diane Warrender (919/728-8595)
Cape Lookout National Seashore: Pat Linebacker and Felix Ravello (919/728-4121)
Rachel Carson Estuarine Sanctuary/Core Banks: Patty Hay (919/728-7317)
Radio Island: J.T. Stevens (919/728-2019)
Morehead City Waterfront: JoAnn Braun (919/247-4003)
Fort Macon State Park: Ranger Scott Hartley (919/726-3775)
Atlantic Beach East: Ruth King (919/223-4176)
Atlantic Beach West: John McKay (919/728-3877)
Pine Knoll Shores: Maureen Parker (919/247-5479)
Indian Beach: Dave and Eva Gagnon (919/247-3614)
Emerald Isle: Jean Zappa (919/354-6776)
Hammocks Beach State Park: Sam Bland (919/326-4881)
Swansboro: Sarah Humphries (919/455-4470)

Southern Region: Sneads Ferry to Caswell Beach
Regional Coordinator: Andy Wood (919/458-8257)
Sneads Ferry: Sarah Humphries (919/455-4470)
Surf City to Topsail Beach: Inez T. Bradt (919/328-2071)
Figure Eight Island: Duncan Phillips (919/686-9448)
Wrightsville Beach: Ed Brooks (919/763-8661) and Tere Barrett (919/341-4191)
Masonboro Island: Richard Gwathmey (919/686-9761); Bill Woodhouse (919/395-3348); and Gail Miller (919/458-5498)
Carolina Beach: Town of Carolina Beach (919/458-8291)
Kure Beach: Nancy Pritchett (919/762-0965)
Carolina Beach State Park: (919/458-8206)
Zeke's Island: Mike Johnson (919/799-5998)
Bald Head Island: Bill Brooks, Bald Head Nature Conservancy, P.O. Box 10999, Bald Head Island, NC 29416
Lee Island: Ron Sykes (919/762-1806)
Oak Island (Caswell, Yaupon and Long beaches): Sam O'Leary (919/279-5518)
Holden Beach: Pat Weaver (919/763-2931 Ext. 271)
Ocean Isle: Hayden O'Neill (704/375-4349)
Sunset Beach: Hubert Reeves (919/763-1312)
Wilmington Beach: John Crowder (919/763-1312)
Hutaff Island: Charlie Baker (919/686-9674)

Beach Sweep '88 has been made possible through donations and support from the following organizations:

McDonald's
Webster Industries/Good Sense bags
Hatteras Yachts
Southern Golf Distributors
Highland Press
Waste Management Company
WWAY-TV Wilmington
Center for Environmental Education

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

The White House lawn must have been impeccable July 26 or someone from North Carolina would have noticed. That's when Beach Sweep coordinators went to Washington to receive an award for last year's cleanup.

In June, the Take Pride in America awards program named North Carolina's Beach Sweep '87 a national winner.

Coordinators for last year's cleanup were UNC Sea Grant, the N.C. Division of Coastal Management, the Office of Marine Affairs and the N.C. Division of Parks and Recreation. Representatives attended the national awards ceremony July 26 on the south lawn of the White House.

In January, Beach Sweep '87 placed first in the government agencies category of North Carolina's Take Pride in America Awards and became eligible for the national competition.

Take Pride in America is a national public awareness campaign to promote wise use of public lands and resources. Its awards program was established to recognize outstanding resource stewardship projects and programs. This year, 540 award nominations were received from 48 states and the District of Columbia.

Beach Sweep '87 brought more than 1,000 people together Sept. 19 for the North Carolina's largest coastal cleanup.

Participants collected more than 14 tons of trash during the three-hour event and recorded each piece on data cards. The cleanup's success spurred organizers to plan Beach Sweep '88, which will be Sept. 24.

The N.C. Aquaculture Development Conference will be held Nov. 1-2 at the Sheraton Hotel in Greenville.

The two-day conference will attract researchers as well as leaders in the aquaculture industry. Conference topics include: an overview of the industry and its economic potential for the state; culture techniques for potential aquaculture species; research; and marketing. Discussion will center on catfish, crawfish, shrimp, hybrid striped bass, mountain trout and tilapia. Participants also will tour aquaculture sites in Pitt County.

Sea Grant Director B.J. Copeland will lead a panel on future research needs for the aquaculture industry. And Associate Sea Grant Director Ron Hodson will describe the potential for the hybrid striped bass.

Other featured speakers for the conference include Richard Lord of New York's Fulton Fish Market, the largest wholesale seafood market in the United States; Larry Delabretonne, a Louisiana State University extension specialist on crawfish production; and Peter Redmayne, editor of *Seafood Leader* magazine.

The conference is sponsored by the N.C. Chapter of the Soil and Water Conservation Society, N.C. Agribusiness Council, N.C. Small Business and Technology Center, N.C. State University College of Agriculture and Life Sciences and the N.C. Department of Agriculture.

To register, contact Rodney Johnson, N.C. Aquaculture Development Conference, 412 W. Queen St., Edenton, N.C. 27932. Or call 919/482-7437.

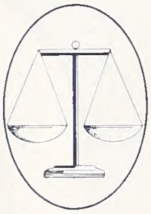
Governor James Martin has established a task force to make recommendations for boosting the state's fledgling aquaculture industry. He has appointed several experts from Sea Grant to serve on committees for the task force.

Sea Grant Director B.J. Copeland is chairman of a committee on aquaculture education, research and technology. Walter Clark, Sea Grant's coastal law specialist, will help to analyze the legal issues surrounding the new industry.

Sea Grant marketing specialist Skip Kemp and economic specialist Jim Easley are on a committee to assess the financial issues of aquaculture in the state.

And seafood specialist Frank Thomas will help analyze the production and processing aspects of the aquaculture industry.

The task force was established to analyze an aquaculture plan recommended by the N.C. Marine Science Council last year.



Walter Clark, Sea Grant's coastal law specialist, recently received an Outstanding Extension Service Award from North Carolina State University. He and nine others were selected from more than 800 eligible extension specialists in the state.

Jim Murray, director of Sea Grant's marine advisory service, nominated Clark for his work with several successful projects in the past year.

In response to numerous requests for legal information regarding beach property, Clark wrote a concise guidebook titled "Your Place at the Beach: A Buyer's Guide to Vacation Real Esate." It was published in conjuction with the N.C. Real Estate Commission and distributed to more than 20,000 people.

Clark also teamed up with Dan McLawhorn, an attorney with the N.C. Attorney General's office, to devise a management plan for water use in the state's estuaries. This work led to a project with the Albemarle-Pamlico Estuarine Study Program that

Continued on next page

will implement the recommendations in North Carolina's Core Sound.

Clark's involvement includes membership on two aquaculture task forces, development of coastal law workshops and conferences, and continued work with the public.

"His programs have had impact in the wise development and conservation of our state and nation's marine resources," Murray says.

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Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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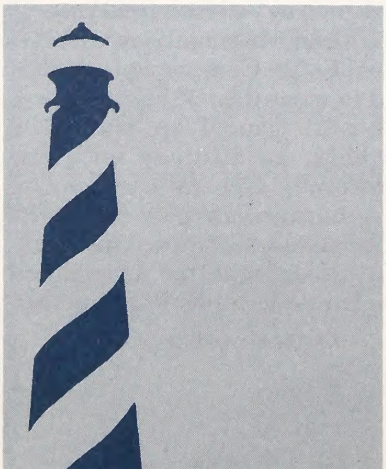

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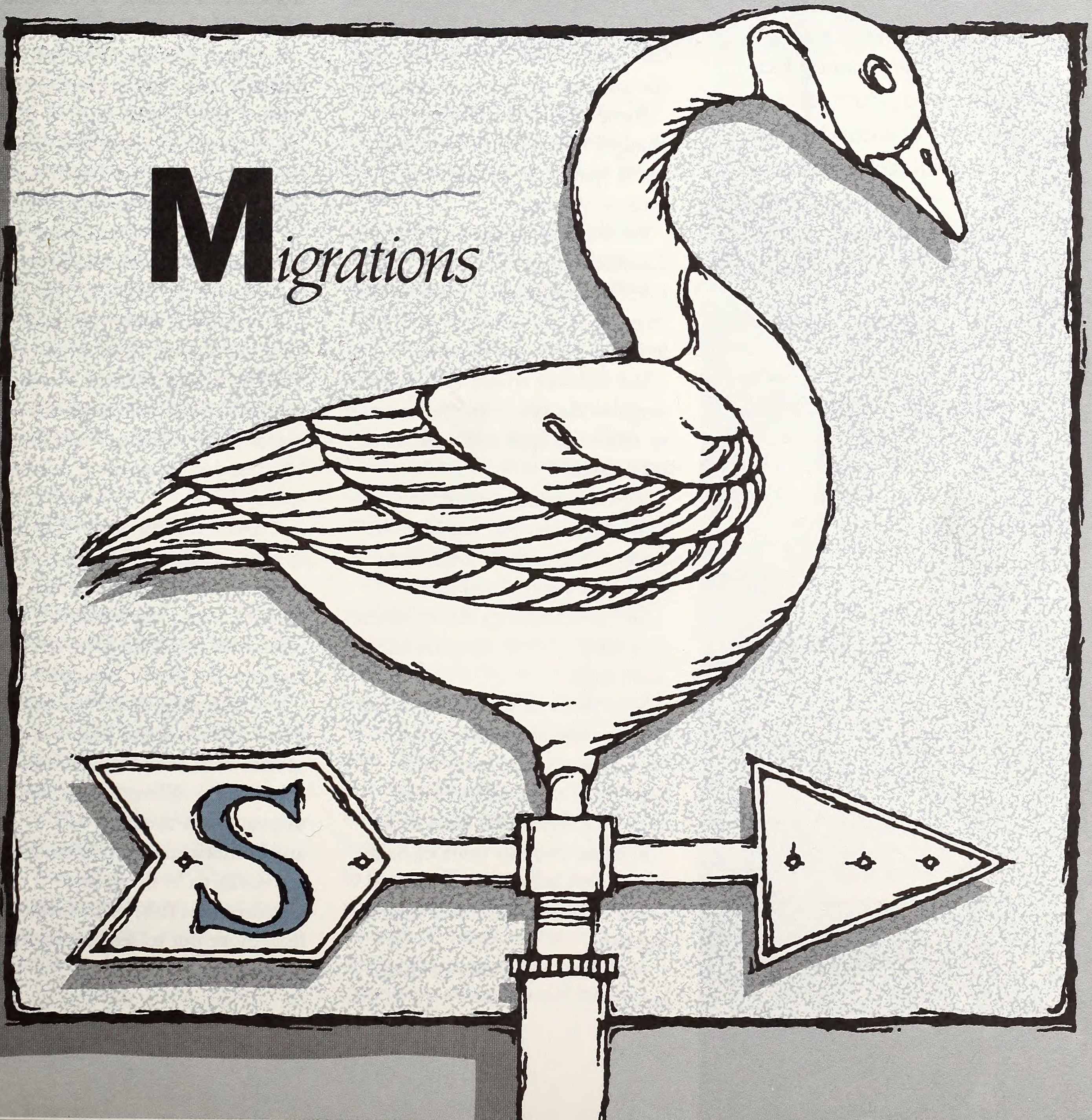

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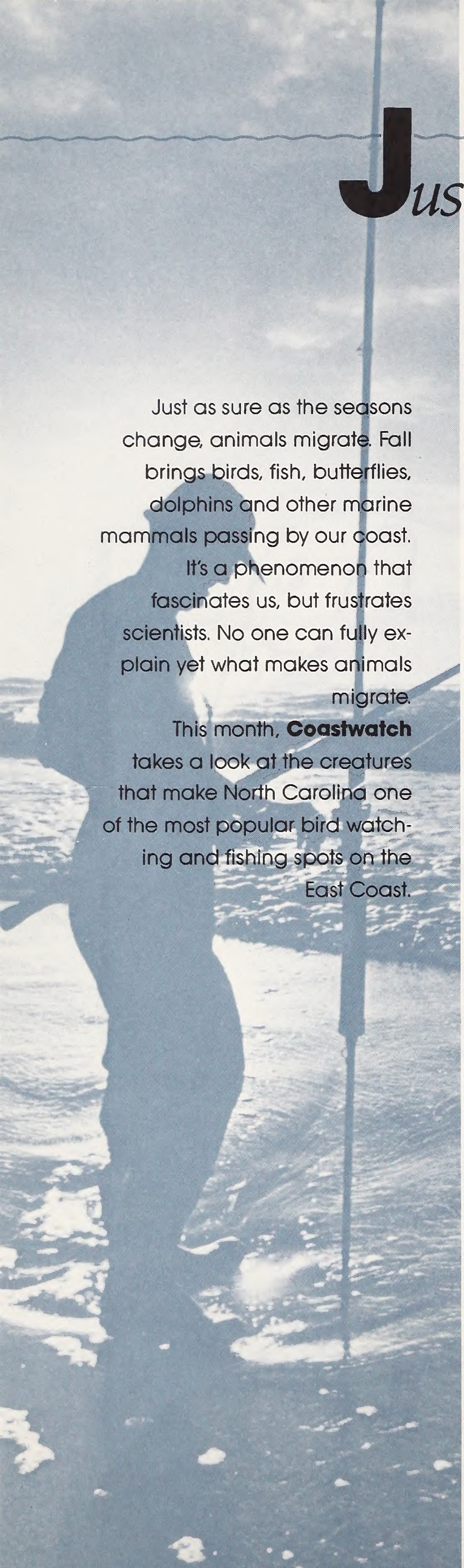


Just Passing Through

By Sarah Friday

Just as sure as the seasons change, animals migrate. Fall brings birds, fish, butterflies, dolphins and other marine mammals passing by our coast. It's a phenomenon that fascinates us, but frustrates scientists. No one can fully explain yet what makes animals migrate.

This month, **Coastwatch** takes a look at the creatures that make North Carolina one of the most popular bird watching and fishing spots on the East Coast.

Ask any North Carolina fisherman his favorite time of year and chances are he'll say the fall.

The weather's cool, the crowds are gone and, of course, the fish are running. Thousands of mullet, blues and mackerels pass by the coast like tourists on the way to Florida.

But ask a fisherman why the fish migrate this time of year and the answers are not quite as clear.

Some say it's temperature changes in the water. Others say it's to spawn, or to find new sources of food.

Scientists seem just as perplexed. Countless theories ranging from celestial navigation to magnet-like "compasses" in a fish's snout attempt to solve the mystery.

Still another school of thought suggests the key to migration may be related to light and a fish's hormones.

While scientists search for answers, angler Harvey Elam waits in the surf off Bald Head Island for a run of red drum.

"It's a fisherman's dream when you catch a 30- to 40-pounder," Elam says.

Sometimes in the fall Elam can snag a drum up to 55 pounds. The fishing's best from mid-September to mid-October, he says. And he doesn't miss a day.

In more than 40 years of fishing, Elam's learned the ebbs and flows of North Carolina's migrating fish.

And there are plenty of them here.

"North Carolina is geographically located where we see a lot of northern species of fish, a lot of southern species of fish and some tropical fish," says Sea Grant advisory agent Jim Bahen.

The warm waters of the Gulf Stream keep the larger and more tropical fish cruising by the state most of the year, Bahen says.

For other species, "The fish basically come about the same time of year," Elam says. In the fall, fish such as swordfish, bluefish and tuna bypass North Carolina on their way south to Florida.

"You know they're coming," Elam says. You wait and watch for the schools, he adds. You know you've hit one when you start catching one fish after another.

In the spring, offshore species swim to cooler waters off the coasts of New Jersey, Maryland, Virginia and other more northern states.

A round trip for larger fish such as tuna, marlin and bluefish can cover as much as 1,000 miles, says Charles Manooch, a research biologist with the National Marine Fisheries Service in Beaufort.

But migrating doesn't always mean a north-south trek. Inshore species such as menhaden and cobia take a different route. Some saltwater fish classified as anadromous species migrate from the ocean to fresh water. Catadromous fish, or freshwater fish, move out to sea—most often to spawn.

Manooch and fisheries agent Jim Bahen agree spawning plays a major role in North Carolina's seasonal fish migrations.

"Herring, striped bass and sturgeon migrations are strictly based on spawning," Manooch says. Other species like spot, whiting and croaker make their moves to spawn, too, Bahen adds.

Most fish spawn over a large geographical area and over a long period of time, so it's hard to pinpoint details on each species. But fisheries experts realize healthy spawning grounds such as North Carolina's estuaries and natural and artificial reefs are vital.

"If we lose those," Bahen says, "we'll see a decline in the species."

Food may be another reason fish migrate. When larger species detect that their food sources of smaller fish are moving on, they follow them.

But North Carolina has plenty of food fish year-round, Bahen argues. "Something triggers that inner clock and says you better start moving south."

It's water temperature, say most fishermen.

Fish are cold-blooded, explains Sea Grant agent Bob Hines. When the water gets too hot or too cool, they move to an area where it's more preferable, he says.

"The water temperature is the key," Manooch says. "There are preferred water temperatures for all species. They stay in the water temperature they want."

King mackerel, for example, like 65- to 70-degree water. Bluefish like the thermometer to read 68 degrees.

Most fish such as tuna, billfish and blues have about a 7-degree range of water temperatures they favor, Manooch says.

Other theories suggest imprinting or certain scents lead fish home. Stars may play a part for some other fish. And one West Coast researcher is testing the correlation between magnetism and migration with fish that have bits of magnetite in their snouts.

Environmental changes and reproduction are the two primary motives for migration, says Bori Olla, a fish behavior scientist at the Cooperative Institute for Marine Resource Studies in Newport, Oregon.

If conditions for fish or any other animals are constant and food is plentiful, they don't need to move, Olla says. But if a fish could not survive in one place because of temperatures or a change in its food source, it is selectively advantageous for the fish and its species as a whole to migrate.

Bluefish, for example, migrate south in the fall to escape low water temperatures and scarce food sources. They travel where they can "get more energy from the environment," Olla says. This leads to higher productivity and larger populations.

His research in Sandy Hook, N.J., and in Oregon points to temperature and light as the forces that trigger migration.

"We're pretty sure light—day length—becomes a signal to the animal," Olla says.

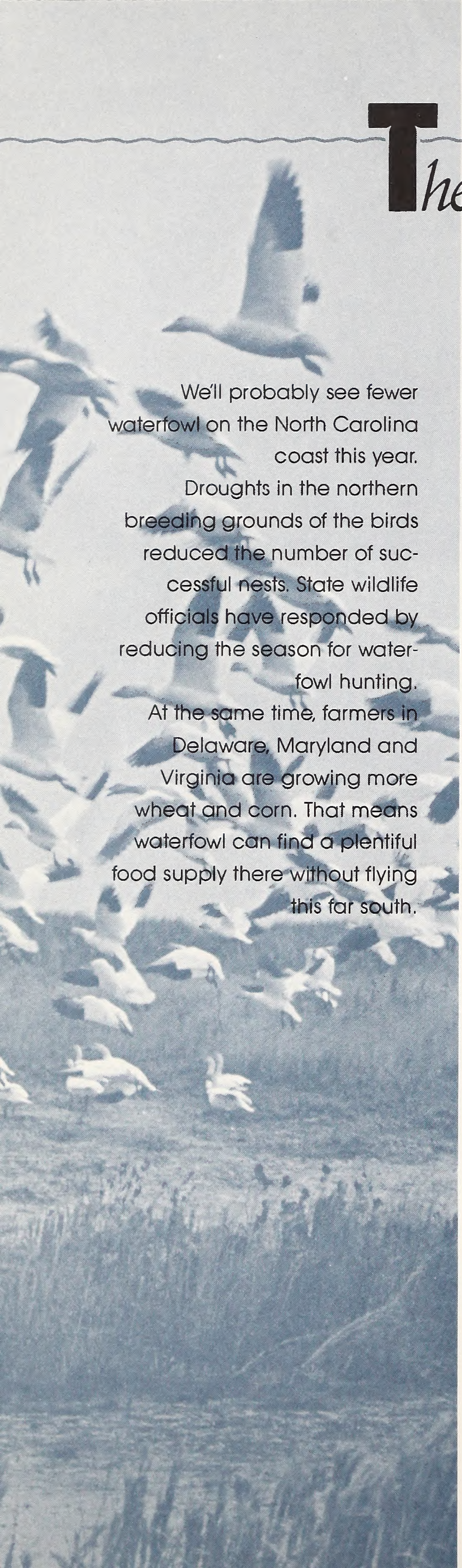
Since the 1920s, researchers have known that the time animals are exposed to light invokes hormonal changes. Somehow that link between light and hormones triggers migrations.

The right combination of light and temperature spurs the fish to move.

While scientists search for answers, angler Harvey Elam waits in the surf off Bald Head Island for a run of red drum.

The Carolina Flyway

By Nancy Davis



We'll probably see fewer waterfowl on the North Carolina coast this year. Droughts in the northern breeding grounds of the birds reduced the number of successful nests. State wildlife officials have responded by reducing the season for waterfowl hunting. At the same time, farmers in Delaware, Maryland and Virginia are growing more wheat and corn. That means waterfowl can find a plentiful food supply there without flying this far south.

For 10 days in the early fall, the sandpiper gorged herself on the crustaceans that were so abundant that time of year in Canada's Bay of Fundy.

She ate so much, in fact, that she nearly doubled her weight.

She would need the energy. She was about to make a non-stop, intercontinental flight to Surinam on the North Coast of South America.

This trip was just for the girls. The rest of the flock would fly down later on a series of much shorter trips.

It's the same every year.

After nesting in the spring and molting in the summer—both energy-demanding activities—these and other birds of passage go on a binge to build up a layer of fat that will provide them with enough fuel for a long trip South.

Then, as the days grow shorter and temperatures get cooler, they get restless to spread their wings.

But what finally sends them packing is a cold front.

The barometric pressure drops and the wind changes direction. They can always count on a good tail wind when a front passes through.

Each year about this time, millions of birds travel from their breeding grounds in the northern United States and Canada to wintering spots in the southern United States or South America, says James Parnell, an ornithologist at the University of North Carolina at Wilmington.

And since coastal North Carolina is in the flight path of many of the migratory birds, the state's beaches and the skies overhead are usually flooded with transients this time of year.

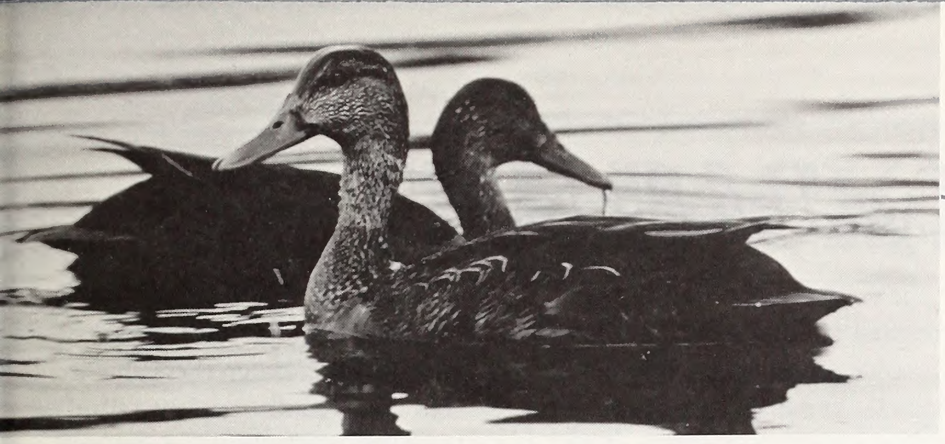
But even though ornithologists can predict almost to the day when certain species will arrive on our coast, they say it's much harder to say **why** they arrive. Obviously, the birds have it figured out, they say. But scientists are still guessing at what makes birds pick up and move on, year after year, often to the same place.

Ornithologist Tom Quay says that birds don't "know" that it's time to migrate. Instead, they "sense" it, he says. "It's an innate, internal, annual mechanism," he says. "It's a built-in response to the weather and climate."

The need to eat also plays a part, says Jeff Walters, a North Carolina State University ornithologist. "For any animal, migration is tied to the food supply. If the feeding conditions change enough so that survival is better in a new area, they'll move on. And birds are real mobile. They can cover such long distances so cheaply in terms of food, it pays for them to move," Walters says.

Parnell has another perspective. "Essentially, birds migrate for the most part from a difficult, harsh winter environment to one that is less difficult," he says.

Whatever the reason, most birds in the Northern Hemisphere migrate in the spring to nest and in the fall to pass the winter.



When it comes time to move south, birds seem to have a meteorological sense about them, Walters says. "Birds are incredibly sensitive to weather conditions. In the fall, they look for a cold front because the winds are usually north/south at the leading edge of a cold front. And the temperatures change at the edge of the front, and the birds sense that," Walters says.

"Then everybody who's fat enough takes off," he adds.

Those north/south winds are partly responsible for North Carolina's popularity with birds. And since our coast is oriented from northeast to southwest, the winds help sweep vast numbers of birds to our shores, Quay says.

For beachgoers, the fall months are a perfect time for bird-watching. There are good locations all along our coast for catching a glimpse of migrating birds, Quay says.

There's no major peak of migration along the Carolina coast in the fall. Instead, you're likely to see birds overhead throughout August, September and October, especially a day or two after a cold front.

Shorebirds, such as sandpipers and plovers, are early arrivals, beginning to move into the state around mid-July.

Colonial waterbirds, including pelicans, gulls, terns, herons and egrets, may stay in the state all winter. But if a hurricane or northeaster blows in, they're likely to head farther South, Quay says.

Waterfowl, including ducks, geese and swans, are regular visitors to the Carolina coast in the winter. Expect to see them during the full moons of October and November, particularly behind a cold front, Quay says.

And there's a heavy migration of hawks, including the endangered peregrine falcon and the bald eagle, along the Carolina coast and the Blue Ridge Mountains.

But when they travel, birds of a feather don't always flock together.

Adult sanderlings, for example, migrate ahead of their young.

But for waterfowl, migrating is a family affair. They all fly south together.

On the other hand, some of the flocks you see overhead aren't quite the tight-knit group they seem. Warblers, for example, don't form special bonds when they travel, Walters says. "Everybody's on their own. They'll join one group one day and another the next. They don't have any migration buddies. Those flocks are just anonymous mobs."

Ornithologists aren't sure how birds navigate. But Walters says they believe birds may use a combination of the sun, stars and magnetism.

Waterfowl, for example, migrate by day, leading experts to believe they may use the sun and topographic memory to guide them on their travels.

But for landbirds, it's a fly-by-night affair. Perhaps they use the stars to guide them.

Even more amazing are the distances migrating birds travel.

If you think the 26-mile marathon is an amazing feat, consider the two-day flight of some shorebirds from the Bay of Fundy in Canada to South America.

Walters estimates some birds are able to fly 20 to 40 mph. Add the help they get from the wind, and they may be moving even faster.

Migrating isn't always a vacation.

The weather, the long trip and the uncertainty of travel make for a tough life.

Storms can blow birds off course. On a recent boating trip to the Gulf Stream, Walters noticed an exhausted warbler taking a rest on the boat.

And with the country becoming more and more developed, birds are running into even more problems—literally.

Skyscrapers pose special problems. For example, it's not unusual to find as many as 2,000 dead birds at the base of a high-rise in Chicago during migrating season, Walters says.

After a long migration, the birds are understandably weary, Walters says. And that makes them vulnerable prey.

"You'll see housecats around town just loading up on migrating birds," he says.

An Eye For Birds

If you've ever driven through coastal North Carolina in the fall, you've probably caught yourself gazing at the flocks of birds that fill the sky.

You may not have been able to identify them, but that doesn't matter. You were bird watching all the same.

That's how Bob Hader, a retired professor of statistics from North Carolina State University, got started.

Hader has been bird watching since 1959 when he built a house near what was then the outskirts of Raleigh. Birds flocked to his heavily wooded yard in such numbers that he bought a bird book and binoculars.

Since then, Hader has turned a hobby into a passion. He's traveled the country looking at birds. For 15 years, he organized the Audubon Society's Christmas count of birds in the Raleigh area. And he's even written a pamphlet, *Checklist of Birds for Raleigh*.

He's not a scientist or a photographer. And he's not out to add one more bird to his list of sightings.

Instead, Hader takes pleasure in just watching, identifying and enjoying birds.

"Birdwatching is a recreation for me. It's a way to be outdoors, get some exercise and do something interesting," Hader says.

"A lot of birders enjoy listing birds. I'd sooner go to the area just to see what's there," he says.

Coastal Carolina is one of Hader's favorite places for watching his feathered friends.

"In the fall, you'll see plenty of shorebirds. And if you're lucky enough to get down there after a cold front, you'll see plenty of landbirds and hawks," Hader says.

Lake Mattamuskeet is a prime spot for watching waterfowl. But he warns, "Get there before the hunters do."

Hader does much of his bird watching by car, stopping every now and then to scan the horizon with his binoculars or telescope.

If you're interested in bird watching, Hader has some simple advice. You don't need a lot of fancy, expensive equipment, he says. Inexpensive binoculars will do.

Then check your local bookstore for a good guide to birds.

The N.C. State Museum of Natural Science's Tail of the Whale Bookstore offers this selection:

Birds of the Carolinas, by Eloise F. Potter, James F. Parnell and Robert P. Teulings, $14.95.

Autumn Land Bird Migrations on the Barrier Islands of Northeastern North Carolina, by Paul W. Sykes Jr., $5.

Checklist of North Carolina Birds, a pamphlet by David S. Lee and Eloise Potter, $.25.

Checklist of Birds for Raleigh, a pamphlet by R.J. Hader and Harry LeGrand, $.25.

The books and pamphlets are available by writing the museum. Please include 5 percent sales tax and $1 for handling and postage. Write to: Tail of the Whale Bookstore, N.C. State Museum of Natural Science, P.O. Box 27647, Raleigh, NC 27611.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

Andy Wood had heard of playing volleyball or an occasional game of baseball on the beach. But until Sept. 24, he'd never heard of beach bowling. Wood, one of the regional coordinators for Beach Sweep '88, said volunteers for the cleanup found a bowling ball from Brazil on Wrightsville Beach.

The ball was one of the more curious finds gathered during Beach Sweep. Altogether, volunteers collected more than 47 tons of trash during the four-hour cleanup. Items ranged from plastic bottles and bags to lawn chairs and mattresses.

Beach Sweep '88 brought 3,500 people to North Carolina's coast, three times the number from last year's cleanup. As volunteers cleared the beaches from Duck to Sunset Beach, they recorded each piece of trash on data cards. Final tallies will be made by the Center for Environmental Education and the Environmental Protection Agency in Washington, D.C.

"From all accounts, Beach Sweep—coastwide—was a major success," says Lundie Spence, Sea Grant's marine education specialist and one of the coordinators for the event. "The volunteers were really enthusiastic," she added. And, "The public support and the media were outstanding."

Spence also noted that some volunteers who had participated in Beach Sweep '87 said that many of the public beaches were cleaner this year. One reason may be new trash cans, but Spence says greater public awareness may have helped, too.

The wild, more isolated areas such as Shackleford Banks and Masonboro Island, however, have not improved, Spence says. And for her, that's all it takes to start planning Beach Sweep '89.

From time to time, *Coastwatch* spotlights some of Sea Grant's research. We want our readers to know more about the problems Sea Grant scientists are trying to solve. But we also want you to know about the benefits of Sea Grant research and extension programs.

This month, *Coastwatch* begins a new series of reports in "The Back Page" that will bring you up-to-date on the results we've achieved with our program.

Before Sea Grant marine agents organized the first North Carolina Commercial Fishing Show, the state's fishermen did not have accessibility to new developments and technologies in the industry.

Now, the annual show features more than 60 exhibitors demonstrating the latest in fisheries technology and a series of seminars on fishery trends and techniques.

The show generates more than $1 million in sales for its exhibitors. And in 1987, the Carteret County Waterman's Association assumed control of the show, enabling them to make a profit that will support their activities.

Sea Grant agent Bob Hines became a "First Mate" this summer without even stepping on a boat. Hines received the "First Mate of the Year Award" from the Carteret County Waterman's Association at a dinner in his honor in July.

The group of Eastern North Carolina fishermen also presented Hines with a VHF radio scanner at the dinner in Morehead City.

Hines was recognized for his support of the association and his work with the North Carolina Fishing Show. Hines started the show in 1982 and has continued to serve as a coordinator until this year.

"We are deeply appreciative of Bob's help in guiding us to the point where we are able to be primary sponsors of the show," write the watermen in their August newsletter. "The N.C. Commercial Fishing Show has been a huge benefit to the Carteret County Waterman's Association. It has opened many doors for us, and established us in the community as an organization."

Meadows of seagrass line the bottom of North Carolina's sounds and tidal creeks. These grasses provide food and protection for the state's young fish, and they contribute to the health of our estuaries.

Two types of seagrasses grow in North Carolina's sounds—northern eel grass and southern turtle grass. Both are flowering plants with small yellow buds enclosed in jelly-like sheaths. Each plant can produce 500 to 1,000 seeds each season. Fish and waterfowl pick and eat the seeds for food. Some seeds are buried by mud-burrowing organisms. The seeds that survive sprout into mature grasses in about two years.

Large seagrass beds are an underwater world of activity. Young scallops find shelter at the base of the leaves. Sea horses wrap their bony tails around the long, slender blades. Juvenile fish dart through the grasses to find food and protection from predators. Millions of burrowing animals such as shrimp, worms and small crabs dig about the roots. And myriads of microscopic plants and animals attach to the blades forming the base of a food web.

The productivity within the seagrass beds is vital to the health of our estuaries. But seagrasses are in trouble.

Once-healthy beds along the East Coast and around the world are dying. The huge grass beds of Chesapeake Bay, for example, have almost disappeared. Where seagrass habitats have declined, so have important fisheries and the number of visiting waterfowl.

Two Sea Grant scientists want to study North Carolina's seagrass beds before it's too late.

Continued on next page

Joanne Burkholder and Larry Crowder speculate that an overabundance of nutrients such as nitrogen and phosphorus causes excessive amounts of algae to grow on the plants. The algae shades the grasses from the sun and photosynthesis is slowed. Eventually the grasses die. The researchers also will test the correlations between small grazing marine animals and the algae.

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COASTWATCH

Our seafood platters are brimming with imports.

Are there other ways to meet the demand? Experts say we may have to learn to eat a wider variety and raise more fish down on the farm.

Serving up imports

By Nancy Davis

If you think the shrimp you had on that Captain's Platter last night was fresh from U.S. waters, think again.

In fact, if you've had shrimp at a restaurant lately, there's a good chance it didn't come from anywhere near here.

About 70 percent of the shrimp we eat comes from fishermen and shrimp farmers from around the world.

And so it is with most of our seafood.

At New York's Fulton Fish Market, the country's largest seafood market, much of what passes through there in a day is imported.

Richard Lord, the market's information officer, can't predict how much of the average 400,000 pounds of seafood a day comes from foreign shores. But if Fulton serves as a microcosm of the U.S. seafood industry, more than 70 percent of that fish and shellfish is imported, he says.

We simply can't supply our demand for fish and shellfish.

According to National Marine Fisheries Service statistics, Americans are eating more seafood than ever. On average, each of us ate 15.4 pounds of seafood last year. And that's 4.8 percent more than we ate in 1986.

To satiate our appetites for food from the sea, we must buy from other nations.

Last year the United States imported a record $5.7 billion of edible fish and shellfish—$897.7 million more than the record value set the year before.

"I don't think there's a country in the world that produces seafood that hasn't exported to the United States," Lord says.

The news comes at a time when import has a negative ring to our ears. We've come to look for that "Made in the U.S.A." label on our clothes, and we expect the same of our seafood.

In October the U.S. Commerce Department reported that the nation's trade deficit for August was $12.2 billion.

And seafood is a big part of that deficit.

In 1987 the United States imported $8.7 billion in seafood products. But its total exports amounted to only $1.6 billion.

Those figures place fishery products second only to oil as the largest factor in the U.S. trade deficit.

But Lord says seafood imports are a necessary evil.

Americans are finicky about the seafood they eat, he says. Despite the wide variety of seafood that could be harvested from our nation's long coastline, we're partial to a few white-fleshed fish such as cod, haddock and flounder. And there's just not enough of it to go around.

"Imports supplement domestic local production of fish in high demand," Lord says.

Imports also help maintain our seafood supply in the winter months when fishing is often curtailed by the weather.

1987 Top Ten Suppliers of U.S. Seafood

	Value	Tons
1. Canada	$1,241	374.8
2. Mexico	$476	79.7
3. Ecuador	$415	73.6
4. Taiwan	$352	103.9
5. Japan	$278	75.2
6. Korea	$248	87.7
7. Thailand	$245	106.9
8. Iceland	$234	62.3
9. Norway	$197	41.9
10. New Zealand	$140	20.8

Figures are in millions of dollars and thousands of tons for edible fishery products. Source: National Marine Fisheries Service.

And for consumers, imports mean we have a steady supply of seafood.

But the American fisherman may have a different view.

For him, imports mean that the guy in the boat docked next to him isn't his only competition.

Instead, he may be up against a fisherman in Japan, a shrimp farmer in Ecuador, a trout grower in France.

"The seafood market is a global market now," says Lord. "Our fishermen are competing in the market with everyone."

But Tar Heel fishermen complain that imports sometimes dictate the prices they get for the catches locally.

And they're right.

Lord explains the economics of imports with the help of the old laws of supply and demand.

If demand for seafood is high, but supplies are low, then prices will be high.

Imports help to stabilize prices by increasing the supply of seafood, Lord says.

"Without imports, the price would be so high on some species that they'd only be available for the very exclusive. Therefore, imports reduce the price for domestic fish," Lord says.

For example, suppose seafood markets offer domestic supplies of gray sole for $10 per pound. But if the markets can import gray sole at cheaper prices, they can offer it for just $8 per pound.

Without that $8-per-pound fish, the domestic $10-per-pound fish would cost consumers even more.

"Prices are market-driven," Lord says. "A lot of people wouldn't be in business without imports. If we only had domestic fish to sell, the prices would be so high that nobody could afford them."

But even so, some American fishermen believe they end up competing with foreign fishermen whose operating costs are lower and whose governments sometimes subsidize their fleets.

Tim Parsons, operations manager with Wanchese Fish Company in Hampton, Va., says that his company won't import seafood.

"Imports hurt us because we're a U.S. commercial fishing fleet. We do not import products because we feel that's in direct conflict," Parsons says.

"Importing is a necessity," says Cliff Lynch, manager of the N.C. Department of Agriculture's seafood marketing program. "But at the same time, it hurts our fishermen."

In some cases, imports have actually taken over a domestic market. Lord cites the Norwegian salmon as an example.

Initially our supply of West Coast salmon was available only in the summer months. But with Norwegian imports, salmon became available to consumers year-round. And even though West Coast salmon still holds the edge with consumers in the West, folks on the East Coast now opt for the Norwegian variety.

Seafood imports are here to stay, Lord says. Without them, consumers would have to go without some of their 15.4 pounds of seafood a year and pay more for it.

But Lord believes we could reduce the level of imports by farming more species and by using a wider variety of the seafoods available in our waters. (See stories, pages 4 and 6.)

And we could offset imports by exporting more of our catches.

Lynch believes North Carolina fishermen should investigate foreign markets, particularly Japan, as possible outlets for their catches.

"The Japanese are just like kids in a candy store," he says. "They have the money, and they're going to import fish because they're such a fish-eating nation."

Jerry Schill, executive director of the N.C. Fisheries Association, thinks consumers can help reduce imports, too.

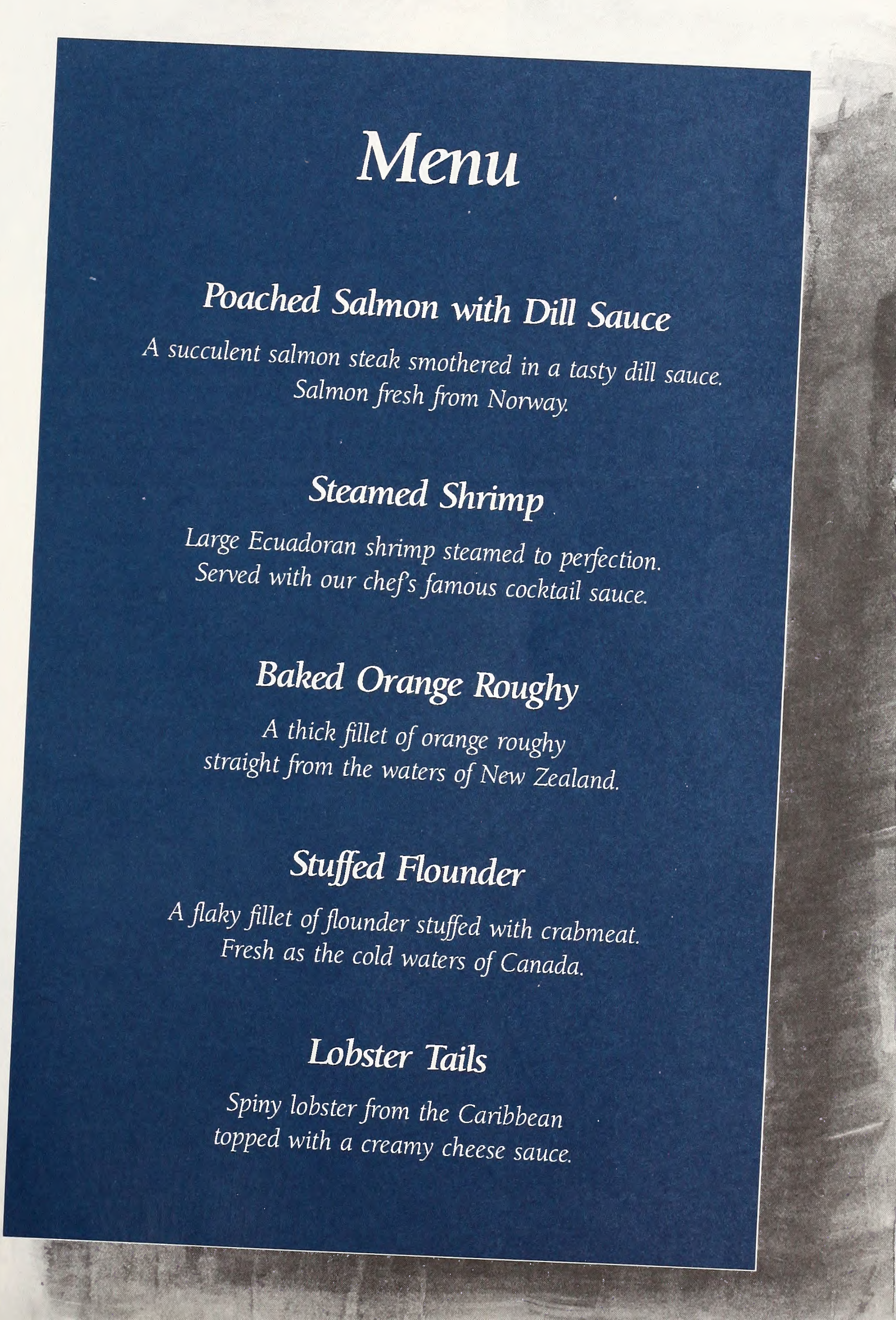
"Most consumers don't know if they're eating domestic or imported shrimp, and many don't care," Schill says. "If the consumer doesn't care where his fish comes from, the restaurant owner doesn't care. They'll just go with the lower price."

And more often than not, the imports will cost less.

But will the quality be as good as our domestic supplies?

Schill doesn't think so.

"We have excellent quality products here," he says. "When you go into a restaurant, just don't say you want a shrimp dinner. Say you want a North Carolina shrimp dinner." ■



Menu

Poached Salmon with Dill Sauce

A succulent salmon steak smothered in a tasty dill sauce. Salmon fresh from Norway.

Steamed Shrimp

Large Ecuadoran shrimp steamed to perfection. Served with our chef's famous cocktail sauce.

Baked Orange Roughy

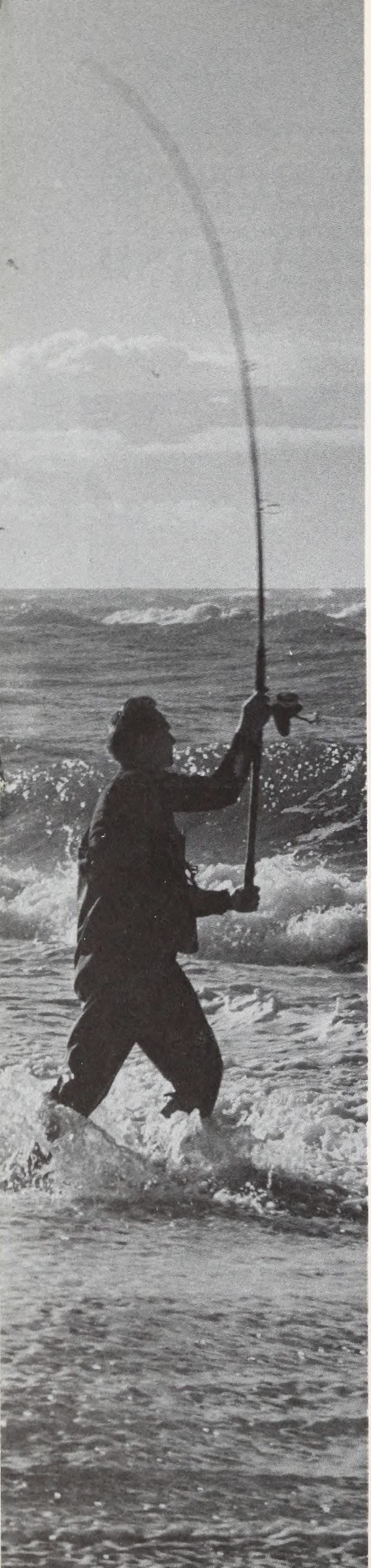
A thick fillet of orange roughy straight from the waters of New Zealand.

Stuffed Flounder

A flaky fillet of flounder stuffed with crabmeat. Fresh as the cold waters of Canada.

Lobster Tails

Spiny lobster from the Caribbean topped with a creamy cheese sauce.



Casting for a new catch

By Sarah Friday Peters

Sea robins get no respect.

You might say they're the Rodney Dangerfield of fish.

And you might as well add triggerfish, amberjack, pigfish and rays to the category, too.

All it takes is one barbed stinger, a spiny fin or an odd-looking shape for a fisherman to shun a fish.

The National Marine Fisheries Service estimates that recreational fishermen catch more than 33 million of these less favored fish each year. But of the 78 species that they reel in in the Southeast, they only keep about 10 or 12, says Jim Murray, Sea Grant's Marine Advisory Service director.

Anglers reject most of the other 66 species for more popular fish like grouper, redfish, snapper and mackerel.

Commercial fishermen, too, often ignore certain species, calling them "trash fish," "garbage fish," and "oddball species."

The image problem comes at a time when consumers want more seafood than ever. And pressures on marine resources are increasing to meet these demands.

Now a fledgling campaign hopes to gain new respect for the Dangerfields of fish. With education, supporters say, fishermen may see these ugly ducklings as beautiful swans.

NMFS, the Gulf and South Atlantic Fisheries Development Foundation, Sea Grant and other fisheries and research organizations began working toward the transformation about four years ago.

Their projects target commercial and recreational interests, but fisheries managers agree that changes in the commercial industry will have the biggest impact.

U.S. fishermen have netted about the same number of pounds of traditional food fish for 45 years, Murray says. Now most of these species are being fished to capacity.

To satisfy our hunger, we import 70 percent of our seafood, says Richard Lord, information specialist with the Fulton Fish Market in New York City.

"We don't have the fishery resources to supply the white-fleshed fish most consumers here require," Lord says. "If we could develop markets for some of the lesser-known seafoods, we'd be able to offset some of our imports," he adds.

The irony is, Lord says, that the U.S. coastline stretches from the Arctic to the tropics and allows for a huge variety of seafood. But European countries with much smaller coasts have a bigger variety of seafood products.

"The point is," Murray says, "we need to use some of that protein we're throwing away."

Take squid, butterfish, dogfish and herring, for instance. These four species occur in large numbers in U.S. waters, but demand in domestic markets has been small, Murray says. A limited market means low value to the states' commercial fishermen.

Nearly four years ago, NMFS recognized the potential for butterfish, squid, shark, and some tuna and herring fisheries in the Gulf of Mexico and the Southeast.

The Gulf and South Atlantic Fisheries Development Foundation also began a push for underutilized species, touting the virtues of species such as mullet, butterfish and soft-shell crab.

Getting the message across is tough, but there have been successes, says Andy Kemmerer, director of NMFS's Mississippi lab in Pascagoula. So far, the lowly butterfish takes the prize.

These shallow water fish, sometimes called "silver dollars," held no market value for U.S. fishermen in the Gulf five years ago. Mostly Japanese fishermen harvested them there for export.

When large concentrations of bigger fish were found further offshore, NMFS and GSAFDF helped develop markets. By 1986, domestic catches of butterfish reached 1 million pounds per year, Kemmerer says. Now figures range from 5 to 10 million pounds, says Tom Murray of GSAFDF.

To duplicate success with other underutilized species, fisheries managers recommend more research on stocks and improvements in production, processing and marketing techniques.

But commercial fishermen say it will take something else for them to abandon their traditional fisheries—proof that profits can be made.

Shrimpers won't start fishing for amberjack, and crabbers won't convert to crawfish unless they have a money-back guarantee.

"It's a hard thing to bend them away from something they've always done," admits lifetime fisherman "Pinky" Lewis of Beaufort, N.C.

For more than 40 years, he and other Downeast fishermen have made a living pulling in shrimp, spot, croaker, flounder and other traditional species.

When other fish land in the nets, he sells them.

"You might not get much for them," he says. "But for some of these odd characters you can get a right good price."

In fact, Lewis began fishing for shark some this year because it was a profitable daytime fishery.

Profits don't concern Bob Emanuel so much. The Raleigh lawyer is a weekend fisherman who likes to catch just about anything running off Core Banks and Cape Lookout.

But Emanuel and the rest of the country's recreational fishermen reel in one third of all the finfish harvested for food in the United States.

"Sportfishermen do have an impact on the fisheries," Jim Murray says.

That's why he and Sea Grant researchers Jeff Johnson and David Griffith of East Carolina University began spreading the word on 16 underutilized species to Southeastern anglers.

Their study of the region's anglers showed that if a fish didn't look "normal," it usually didn't make it to the cooler. Lumps, wings, stingers, skin like salamanders, spines or whiskers like porcupines disqualified a fish, Murray says. So did puffing up and grunting.

But one taste of triggerfish and a bite of bluefish convinced fishermen that beauty was in the eye of the beholder.

To dispel the myths and the bad reputations, the team tapped the anglers' grapevine—pier and marina owners, outdoor editors, tournament leaders and opinion makers. And they developed a set of brochures and posters showing how to catch, clean and cook species like sea robin, mullet, pigfish and ladyfish. A tournament director's guide, a recipe booklet and a slide program reached other audiences.

After four years, Murray is pleased with Sea Grant's efforts. A survey showed more than 90 percent of the people who received the materials said they would keep the less popular fish on their next fishing trip.

"We won't turn a blue marlin fisherman into a skate fisherman," Murray says. "But we just want to increase the demand for and the use of some of the underutilized species." ■

For more information on these Sea Grant publications, see The Back Page.

Fish from the farm

By Nancy Davis

Americans are on a feeding frenzy.

When it comes to seafood, we're cleaning our plates and begging for more.

But as our appetites for fish and shellfish grow more voracious, our harvest is remaining about the same.

Does that mean we're destined to import even more seafood than we do now?

Maybe not.

Last year, farm-raised fish and shellfish accounted for 14 percent of our seafood supply. And some experts predict that by the turn of the century, fish farmers will supply 25 percent of the world supply.

Ron Hodson, Sea Grant's associate director and head of the program's aquaculture research, agrees that everything points to aquaculture playing a big part in meeting future demand for seafood.

He says, "The demand for seafood is one of the major driving forces behind the interest in aquaculture in the United States."

The aquaculture industry is already supplying us with about 400 million pounds of seafood a year, Hodson says. That includes an estimated 25 million pounds of salmon, 280 million pounds of catfish, 40 percent of our oysters and nearly 100 percent of our freshwater trout.

Other species he believes show promise are shrimp, redfish, clams and the hybrid striped bass.

In North Carolina, fish farmers have already established a flourishing industry with mountain trout and catfish.

In a survey of the industry here, North Carolina State University zoologist Jim Rice found that over 230 growers were producing a wide variety of aquaculture products.

But even for all the talk of aquaculture saving us from imports, Hodson tempers his enthusiasm with concern over some obstacles that must be overcome.

Aquaculture has met with some opposition, he says.

Frequently, fish farmers face legal and regulatory constraints. Often the laws were intended to regulate wild catches, but end up inhibiting the sale of farm-raised species.

And in one state, opposition by fishermen has led to a moratorium on aquaculture.

The reason?

Some fishermen fear that farm-raised fish and shellfish will compete with their catches.

In Alaska, opposition from fishermen reached such proportions that this spring the state banned aquaculture for two years.

The controversy arose over salmon net-pen culture. Salmon fishermen were afraid that the commercial culture of salmon would lead to an over-supply and a resulting drop in the prices they receive for their harvest of wild fish.

Ironically, U.S. researchers developed much of the technology for salmon culture.

But because of legal constraints that have hampered the industry here, cultured salmon from Norway, Canada, the United Kingdom and Japan dominate our market.

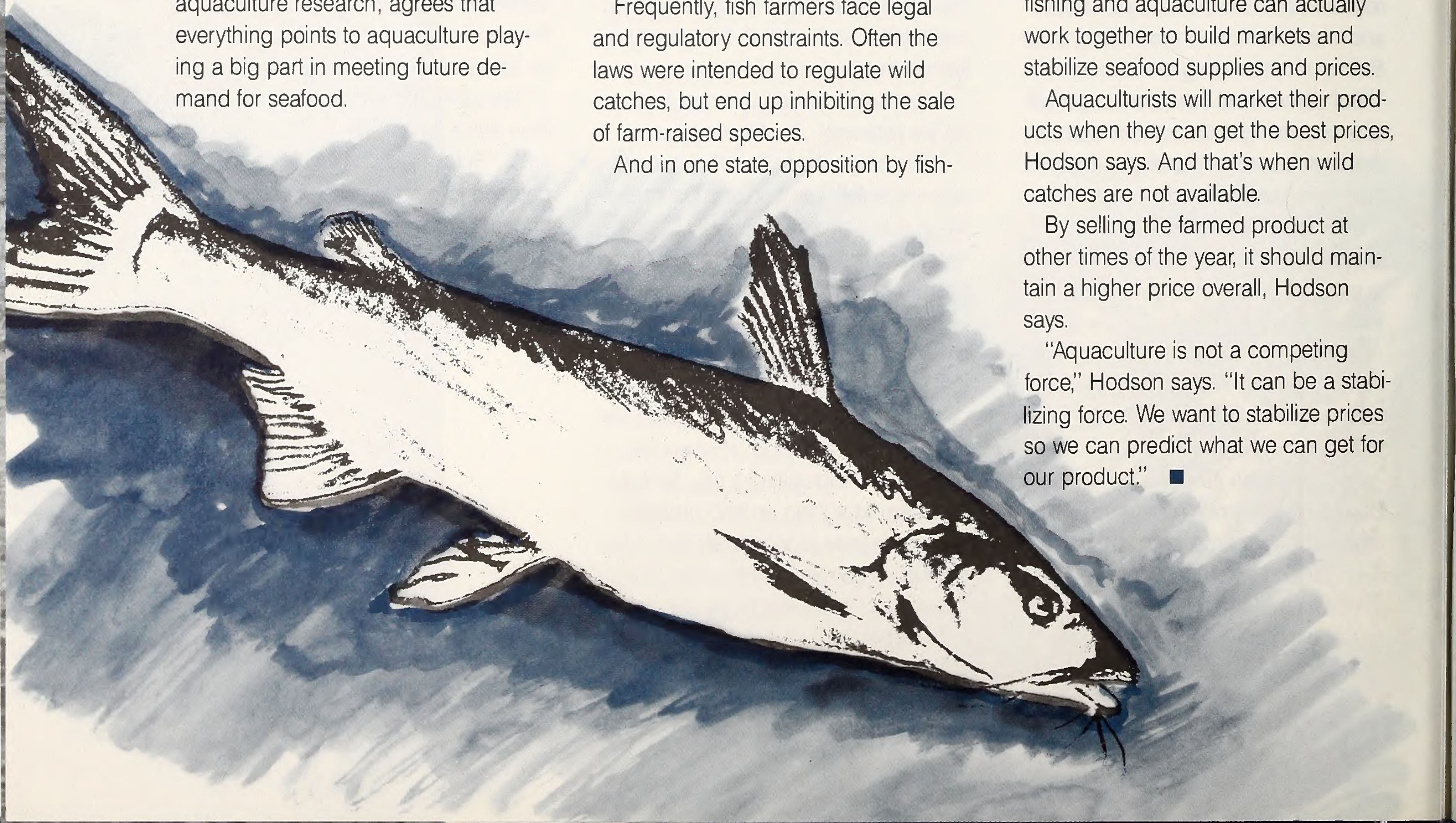
The result is that the Alaskan fishermen are already competing with fish farmers, Hodson says. But the competition is coming from foreign imports of farm-raised salmon.

Hodson believes that commercial fishing and aquaculture can actually work together to build markets and stabilize seafood supplies and prices.

Aquaculturists will market their products when they can get the best prices, Hodson says. And that's when wild catches are not available.

By selling the farmed product at other times of the year, it should maintain a higher price overall, Hodson says.

"Aquaculture is not a competing force," Hodson says. "It can be a stabilizing force. We want to stabilize prices so we can predict what we can get for our product." ■



THE BACK PAGE

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Thanks to your generosity, the October and the November/December issues of *Coastwatch* were printed with the help of your donations.

The staff of *Coastwatch* appreciates your continued support.

For decades, fishermen have known the secrets of the rich underwater reefs on North Carolina's continental shelf. Now Sea Grant scientists are exploring riches of another kind there.

Geologists Stan Riggs, Scott Snyder and Al Hine have been searching the bottomlands called "hardgrounds" for phosphate deposits and other minerals.

Phosphates, shell and quartz gravels, gold and uranium are important resource minerals for the United States. But the extent and potential value of these minerals, especially phosphate, on the continental shelf has been unknown.

Recently the Sea Grant team discovered eight units of phosphate reserves in Onslow Bay that they estimate hold 20,752.5 million tons of phosphate concentrate. The approximate worth is $1 billion, says Sea Grant Director B.J. Copeland.

Riggs and Snyder mapped the hardgrounds and determined their depositional history. And the U.S. Minerals Management Service evaluated the deposit's economic potential and approved of mining it if necessary.

Until then, fishermen can reach these underwater fish havens with the help of a map devised by Sea Grant's researchers. The large, four-color map charts low-, medium- and high-relief reefs on a Loran grid. And it depicts the small plants and animals that attract gamefish such as snapper, grouper and sea bass.

For a copy of the Hardbottoms map, write Sea Grant. Ask for UNC-SG-86-25. The cost is $5.

Try out a new taste in fish by catching Sea Grant's 16 non-traditional fish brochures. These colorful pamphlets feature underutilized species from Gulf and South Atlantic waters. And they describe how to catch, clean and prepare the fish. Recipes are also included.

Series 1 includes: UNC-SG-85-09 to UNC-SG-85-18 (amberjack, sea robin, skates and rays, triggerfish, panfish, jack crevalle, shark, sheepshead, bonito and croaker); Series 2 includes: UNC-SG-86-13 to UNC-SG-86-18 (black drum, bluefish, ladyfish, mullet, pigfish and sea catfish). Each series costs $1.

Recipes with a New Catch is a 40-page cookbook chocked full of delicious recipes for cooking underutilized fish. Shark creole, buttermilk-fried croaker fillets and grilled triggerfish with wine sauce are just three of the 56 dishes included. For a copy, send $2 to Sea Grant. Ask for UNC-SG-86-06.

For a new twist in fishing tournaments, directors may want to scan *Using Nontraditional Fish in Saltwater Sportfishing Tournaments*. The 20-page booklet tells how amberjack and other species can be used for tournaments and demonstrates some of the alternatives available to organizers. For a free copy, write Sea Grant, and ask for UNC-SG-86-05.

For the fifth straight year, Americans ate more fish and shellfish than ever before. On average, we consumed 15.4 pounds of seafood in 1987—4.8 percent more than in 1986. In the past five years, U.S. seafood consumption has increased 25 percent. By comparison, poultry consumption was up 23 percent for the same period. Pork consumption only grew by .5 percent, and beef and veal consumption declined 1.8 percent.

Between North Carolina's mainland and the Outer Banks lies one of the nation's largest estuarine systems. Once it teemed with healthy grasses, young fish and other types of marine life.

Now that productivity is threatened—so much so that the Albemarle-Pamlico sound system was the first officially designated "Estuary of National Concern."

To combat declining fish populations, pollution and other symptoms, the N.C. Department of Natural Resources and Community Development and the Environmental Protection Agency began a five-year Albemarle-Pamlico Estuarine Study.

Sea Grant recently received $230,079 from EPA to fund four projects in the second year of the study.

Researchers R.W. Skaggs and J.W. Gilliam of N.C. State University will be investigating land use in the watershed and how it affects estuarine water quality.

NCSU oceanographer Len Pietrafesa plans to study the links between the Albemarle and the Pamlico and other bodies of water that surround them for a better understanding of the estuary's productivity and water quality.

Ed Noga of NCSU's School of Veterinary Science is taking a look at a disease that's caused a four-year decline of blue crab in the Albemarle-Pamlico and its relation to the environment.

And Walter Clark, Sea Grant's coastal law specialist, will develop a pilot program, using a county surrounding the Albemarle-Pamlico estuary, that will help in managing multiple uses of public trust waters.

APES announced its third Call for Proposals on Nov. 18. It is seeking research and public involvement projects that will lead to an effective conservation management plan for the

Continued on next page

Albemarle-Pamlico region.

Robert E. Holman expects funds from NRCD and EPA to total about $1.2 million for the third year of the study.

Deadline for proposals is 5 p.m., Jan. 13, 1989. No proposals will be accepted after this date.

For more information, write Holman at NRCD/Albemarle-Pamlico Estuarine Study, 512 N. Salisbury Street, P.O. Box 27687, Raleigh, N.C. 27611.

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Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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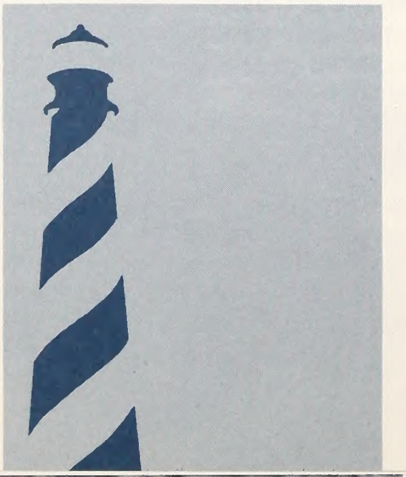

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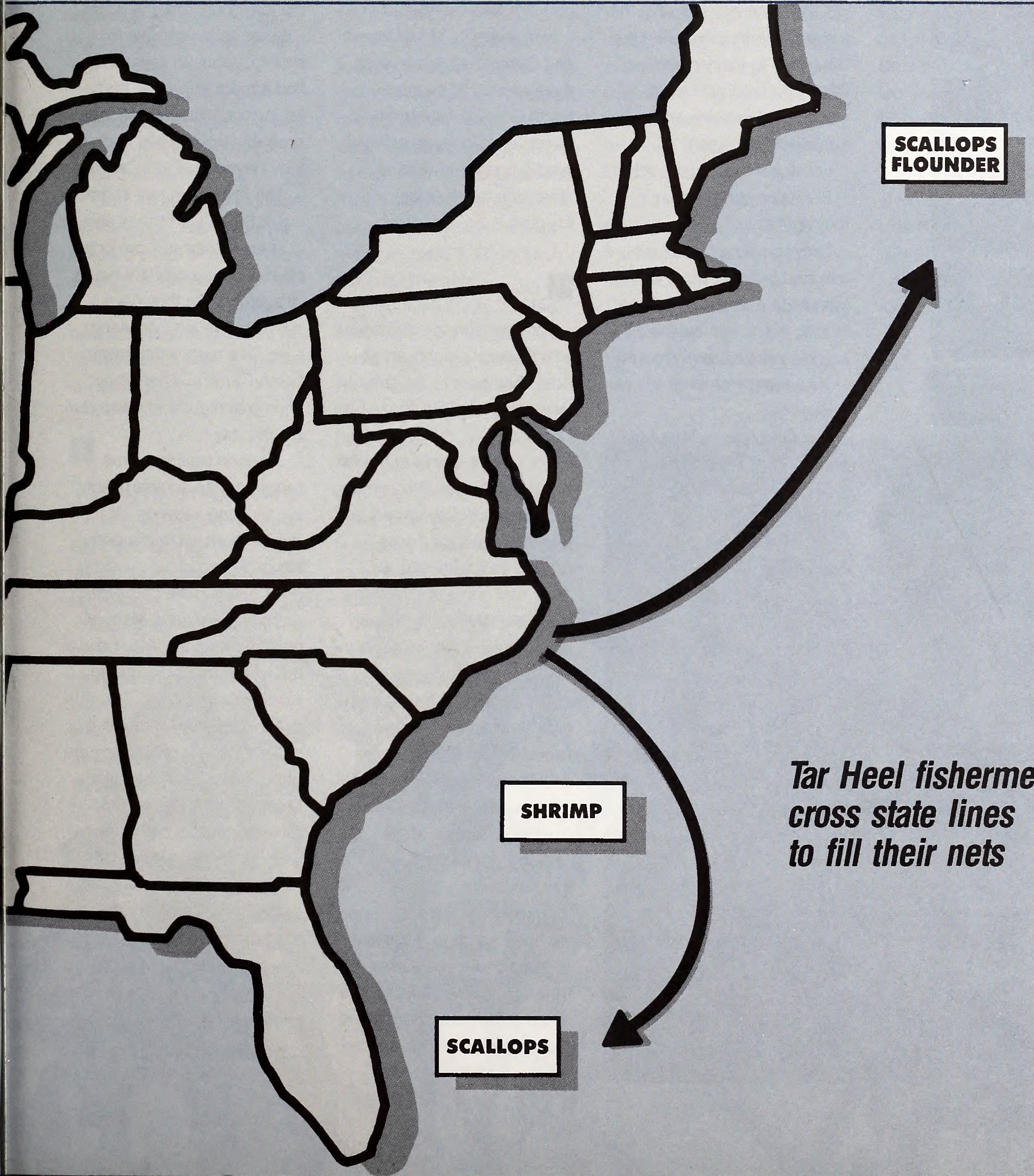


Tar Heel fishermen cross state lines to fill their nets

N.C. FISHERMEN

Researchers find fishermen live up to their reputation

By Kathy Hart

North Carolina fishermen have made themselves a reputation.

You can hear it whispered on the docks in McClellanville, S.C.; Cape Canaveral, Fla.; and New Bedford, Mass.

Off one person's lips, it's said with respect; off another's, there's a mixture of spite and jealousy.

But no matter where it's whispered or how it's said, it is a reputation that links Tar Heel fishermen to every major fishery on the East Coast.

Just what is being said about our fishermen?

For one thing, they're smart.

But more importantly, they're mobile.

They're willing to kiss the wife and kids goodbye for months at a time so they can fill their holds with seafood and their pockets with money.

It's a reputation born of necessity.

Sea Grant researcher Mike Orbach says there is no one North Carolina fishery that has the abundance, value or availability to support a fisherman and his family year-round.

Tar Heel fishermen must either switch fisheries within the state or go out-of-state to extend seasons or to follow the fish.

Many fishermen are choosing to cross state lines—to challenge fishermen from New England to Florida and sometimes beyond—for their catch.

But when the harvesters go to other states or regions, it creates unique interdependencies between fishermen, seafood dealers, processors and management agencies.

These interdependencies and the lifestyle of North Carolina's transient fishermen sent three East Carolina University anthropologists roaming out-of-state docks as part of a Sea Grant study.

Jeff Johnson, Mike Orbach and Danny Rasch surveyed three groups of migratory North Carolina fishermen. Rasch and Johnson actually lived among and worked alongside the Tar Heel travelers.

■

Jeff Johnson headed south with Carteret County small-boat shrimpers to the shrimp-laden shores of South Carolina.

For several weeks in the fall of 1986, Johnson lived among a contingent of shrimpers who docked in muggy, moss-draped McClellanville, S.C. They had come south to extend their shrimping season after a mediocre harvest in the Tar Heel state.

The shrimpers hailed from Downeast towns—Harkers Island, Marshallberg, Davis and Stacy. But, during the fall, home was the 21- to 45-foot boat they docked at the seafood dealer's in McClellanville.

Usually Tar Heel shrimpers sell their catch to the same seafood dealers year after year. In return for their loyalty, the dealers provide the travelers with a few amenities and advance information about expected shrimp yields.

If North Carolina waters yield a bumper crop of shrimp or the crustaceans are few and far between in Sandlapper country, fishermen stay home.

It's the so-so years that send shrimpers south. But the shrimpers acknowledge that there are social reasons for the migration, too.

Some fishermen like to shrimp, Johnson says. They find it more enjoyable than fishing for finfish, which they probably would have to do if they stayed in North Carolina.

And fishermen say, shrimping in South Carolina is easy.

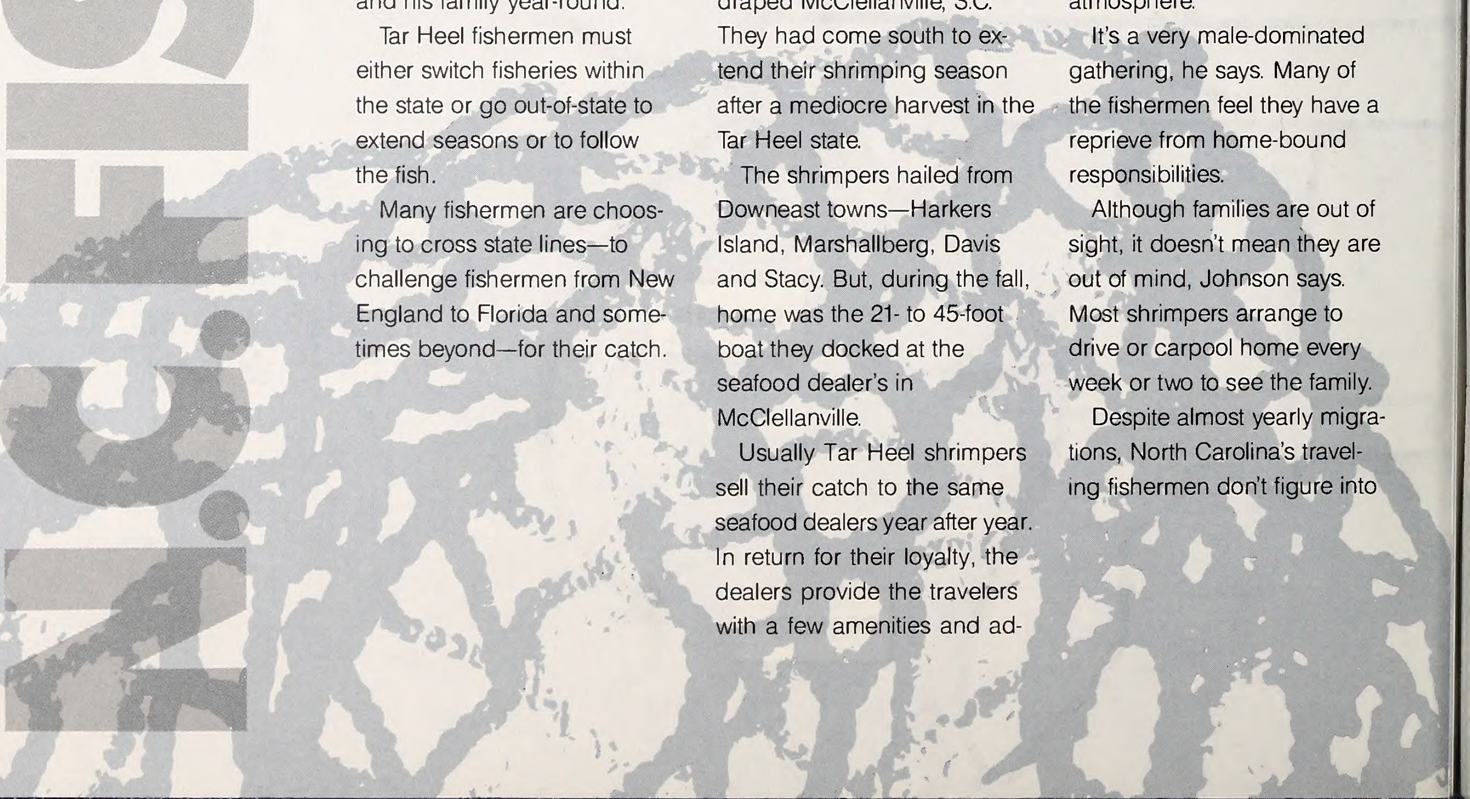
There, fishermen can only shrimp during daylight hours. "It's almost like they have a nine-to-five job," Johnson says. "It's such a contrast to North Carolina where they shrimp at night and sleep during the day."

Johnson says for some fishermen the southern jaunt is a working vacation. At the docks, there is often a party atmosphere.

It's a very male-dominated gathering, he says. Many of the fishermen feel they have a reprieve from home-bound responsibilities.

Although families are out of sight, it doesn't mean they are out of mind, Johnson says. Most shrimpers arrange to drive or carpool home every week or two to see the family.

Despite almost yearly migrations, North Carolina's traveling fishermen don't figure into



South Carolina's fishery management plans.

"State management agencies take care of their own," Johnson says. "They hardly know anything about transient fishermen, and they don't know how their decisions affect fishermen in other states."

For now, Tar Heel shrimpers buy a South Carolina commercial fishing license and adhere to Sandlapper regulations just as native fishermen do.

All in all, Johnson was impressed by the ingenuity and mobility of North Carolina's small-boat fishermen.

"Sure I'd seen the big boats on the West Coast travel hundreds of miles to participate in a fishery," Johnson says. "But when you see a fisherman take a 26-foot boat 200 to 300 miles to catch shrimp, that's surprising."

■

Danny Rasch signed on for the long trips of Wanchese's big boats as they ply northern waters for flounder and sea scallops.

The 80- to 120-foot Wanchese boats usually follow the herds of flounder along the New England coast from March until late fall. But if the sea scallop harvest is favorable, the captains re-rig for the mollusks during the summer.

The trips offshore usually last from nine to 12 days for flounder, 11 days for scallops. And most boats have a five-man crew and captain.

Rasch says the captains establish a rotation system for the crew. Each week one crew member flies home while the others stay behind to work.

The captain works trip after trip "until he can't stand it anymore," Rasch says. "Then everybody takes a week off."

Rasch says the work, especially aboard the flounder boats, is grueling. From the first haul of flounder until the last, the crew works two hours, then rests two hours. On the scallop boats, the crew works six-hour shifts.

If the catch is poor during a trip, the captain and crew may spend a few extra days at sea netting "shack" fish—nontargeted species such as lobster, mudfish and monkfish. Rasch says that bringing in a good haul of shack fish can mean an extra $200 to $500 per crew member.

If you think these Tar Heel fishermen are a tough lot, you should meet their wives, Rasch says. "I have real respect for the wives of these fishermen.

"They can never plan anything," he says. "They never know how long their husbands will be away or how much money the men will make."

That's why Rasch says that it is important for the women to have multiple sources of funding—parents, other relatives or friends.

Besides financial worries, the women must also endure the loneliness of being away from their husbands. That's where the support of a community as tight-knit as Wanchese comes into play, Rasch says.

When North Carolina fishermen finally slide into New Bedford's harbor, they dock at the same pier.

The New Bedford docking system is segregated, Rasch learned. Portuguese fishermen claim one pier; New Bedford natives, another. And the third pier is strictly for North Carolinians.

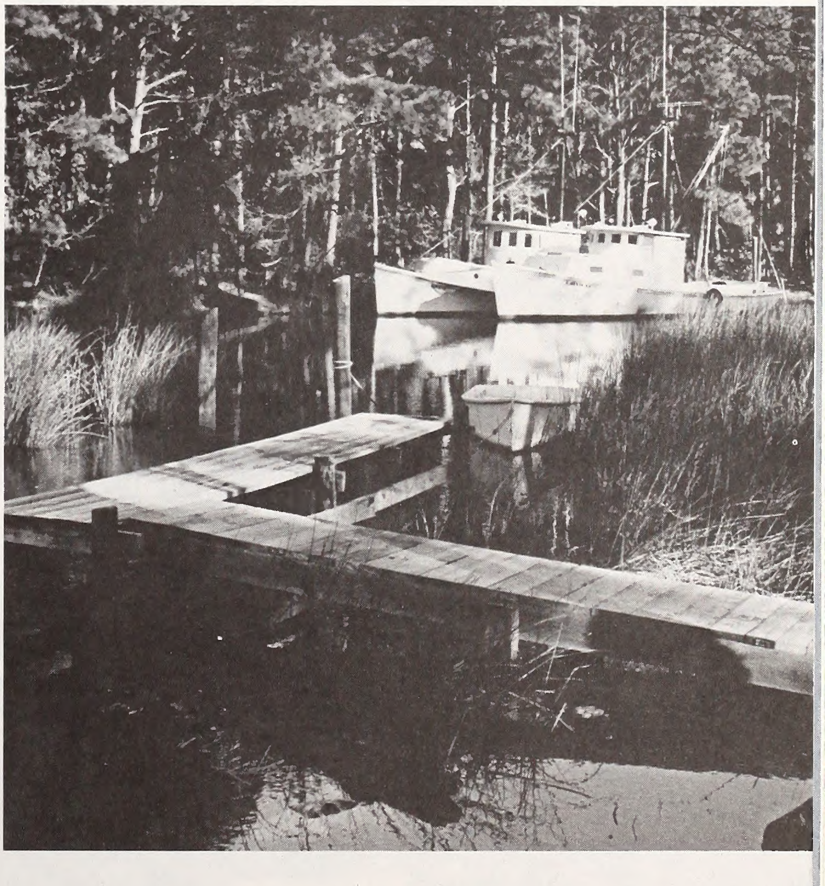
Off the boats, the North Carolina fishermen stay to themselves, Rasch says. They don't interact with New Englanders unless it's a matter of business.

New Bedford businessmen like the Tar Heel fishermen. "They tell me the Southerners are more gentle, don't fight as much and are prompt in paying their bills," Rasch says.

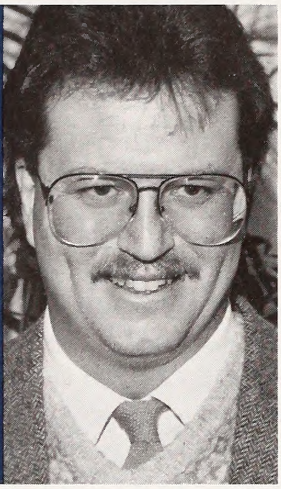
But New Bedford fishermen, native or Portuguese, have different opinions. They consider their southern counterparts "red-neck scum" who take their jobs and steal their fish, Rasch says.

But they shouldn't speak too loudly if they want to sell their catch. North Carolinian Kenny Daniels of the Wanchese Fish Co. buys all the flounder unloaded at the New Bedford docks.

New England fishermen aren't the only ones who don't give North Carolinians much respect. The New England Fishery Management Council ignores Tar Heel flounder



Fishermen take small boats like these south to shrimp



Danny Rasch

fishermen despite a 30-year participation in the fishery, Rasch says.

But the council did recognize North Carolina scallopers in the early 1980s when they entered into a fray over a proposed size limit for sea scallops.

* * *

Mike Orbach surveyed Carteret County fishermen who periodically dash off to the Florida coast to cash in on the lucrative calico scallop harvests.

In the fall and winter, 20 to 30 North Carolina fishermen occasionally hightail it to Florida's northern Atlantic coast to scoop up calico scallops from newly discovered beds.

All it takes is a call from one of the scallop processors in Florida. Many of the processors have ties or even processing plants back in North Carolina.

In fact, North Carolinians have dominated this Florida fishery since the first large beds of calico scallops were discovered in 1980.

Fishermen from Wanchese to Swansboro headed south. Nearly half of the scallop fleet working out of the Canaveral docks in the early 1980s were North Carolinians. Some fishermen even moved their families to Florida.

The lure?

"The scallops carried a high value, and it was a dead-easy fishery," Orbach says. "Everybody knew where the beds were. All the boats had to do was go to the beds, shovel up the scallops, head back to the docks, unload them and go out again. They worked 24 hours a day."

North Carolina processors cashed in, too. Much of the machinery needed for shucking the scallops sat in plants on the shores of Carteret County.

Truckload after truckload of calicoes was hauled to North Carolina for shucking. But eventually the processors moved their equipment south.

And just as the South Atlantic Fishery Management Council set its sights on a calico scallop management plan, the fishery collapsed.

Tar Heel scallopers headed home, and the management plan was shelved.

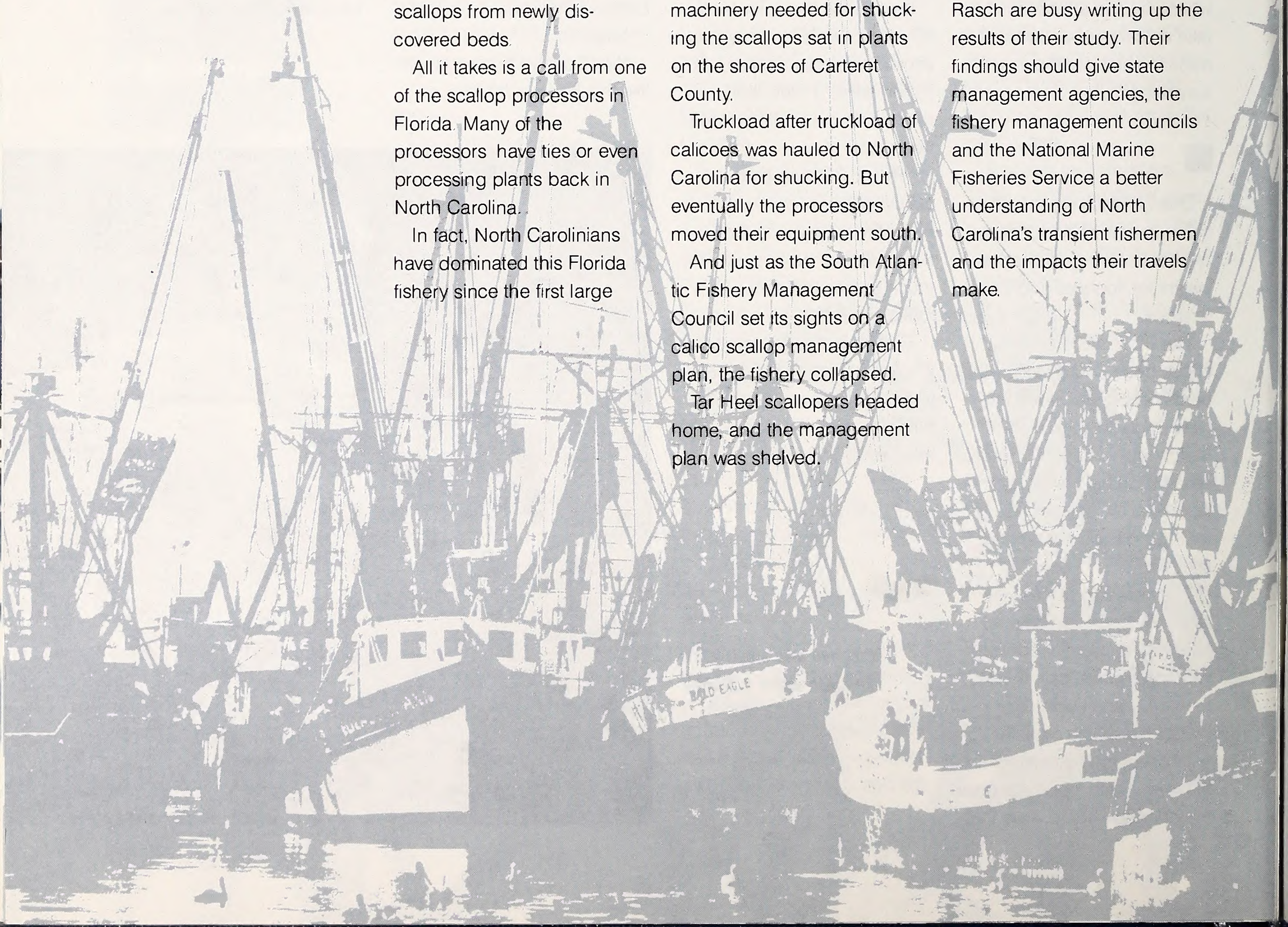
But in recent years, new beds of the calicoes were found, and processors called in their fishermen friends from North Carolina again.

Because of North Carolina's dominance in the fishery and in the processing, there has been little conflict and resentment over the Tar Heel invasion, Orbach says.

And the South Atlantic Fishery Management Council is eager for the results of this study. If the fishery booms again, the council wants to be prepared with as much information as possible, Orbach says.

* * *

Johnson, Orbach and Rasch are busy writing up the results of their study. Their findings should give state management agencies, the fishery management councils and the National Marine Fisheries Service a better understanding of North Carolina's transient fishermen and the impacts their travels make.



N.C. FISHERMEN

Fishermen explain what lures them to travel

By Nancy Davis

The black lettering on the stern of Punk Daniels' fishing boat proclaims Wanchese as its home port.

But the words are deceiving. The 70-foot "Venus" is just as likely to dock in ports in Maine and Canada as in North Carolina.

The days of the provincial commercial fisherman are gone. To bring in money year-round, Tar Heel fishermen say they must look beyond the waters their grandfathers fished.

The result is a breed of fisherman that is mobile, aggressive, smart, industrious and business-like.

For months at a time, Daniels and fellow Tar Heel fishermen leave home and family hundreds of miles behind. And back in towns like Wanchese, Marshallberg and Supply, wives and children wait for a weekly phone call, a monthly visit and a paycheck in the mail.

And whether they're scalloping off the coast of Maine or shrimping the waters around Key West, Fla., they command respect, and sometimes resentment, from their counterparts in other states.

"Fishing hasn't been real good here in North Carolina, so a lot of these people are having to go far and wide to make it in the business," says UNC Sea Grant Director B.J. Copeland. "Some people are going to be amazed at the distances these guys go for fish."

Some North Carolina fishermen migrate to neighboring states when the pickings are slim here. Others travel as far north as Canada and south to the Florida Keys.

Wanchese fishermen are likely to go north to fish for flounder and scallops. Fishermen from the state's central and southern coast often travel south to shrimp.

Marshallberg fisherman Jerry Kellum says he would fish in Core Sound all year if he could make a profit on his catches of shrimp, oysters and clams.

"If there's something here, I'll stay here," he says. "But I just move around so I can catch more and make more."

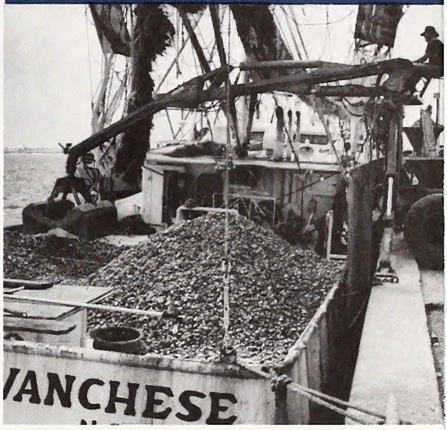
For the past few years, Kellum has taken his 30-foot trawler to South Carolina waters where shrimp have been more plentiful.

Daniels starts fishing on the "Venus" in January around Cape Hatteras for flounder. He works his way north along the coast until he ends up on Georges Banks off the coast of Maine and Canada in April.

If the price of flounder drops, Daniels rigs his boat for catching porgy and sea bass.

Hobucken fisherman Forest Williams owns three boats, ranging from 73 feet to 87 feet.

His crews fish for flounder in New Jersey waters in the fall. They follow the fish south until they're in Virginia Beach by the first of November. Then they work along the Carolina beaches until the fish move back north to deeper waters. When summer approaches, Williams' crews will shrimp off of North and South Carolina or scallop off Cape May, N.J.



Tar Heel fishermen cash in on this bountiful harvest from the Florida coast

North Carolina's traveling fishermen approach their profession for the business it is. They know that a successful fishing season has little to do with luck. It depends on old-fashioned hard work, they say.

And sometimes their success riles the fishermen in other states.

"I reckon sometimes they feel like they'd get along better if out-of-state boats would stay at home," says Red Brooks of Harkers Island.

Daniels, who says some Northern fishermen resent the North Carolina presence in their territory, has a comeback ready for them.

"We just tell them the war's over," he says. "We have to work hard. We don't care whose waters we're in."

Williams says any resentment is unfounded. He likens it to a deer hunt.

"If I was going deer hunting in my own back yard, I'd know where to look and where to kill me a deer. But if a fellow from Beaufort came over, he wouldn't know where to find him a deer.

"Well, it's the same way up there," Williams says. "We're in their back yard.

"North Carolina fishermen are aggressive. We hear it all around. It's what we do for a living. We're hard workers. It's a real competitive business. When you're in competition, you're going to go that extra mile, and North Carolina fishermen are willing to do that," Williams says.

The hard work pays off in bigger catches, Kellum says. And that can create animosity. "From past experiences, I think North Carolina fishermen catch more than South Carolina boats," he says.

Because North Carolina shrimpers have smaller boats, they are able to fish in shallow, nearshore waters. They catch the shrimp as the crustaceans move from their inland nursery grounds offshore to spawn in deeper waters.

South Carolina fishermen believe the Tar Heels catch a disproportionate number of the shrimp before they get to the deeper waters.

Complaints fill the air waves. "I hear them talk about it on the radio. 'Those North Carolina folks are down here cutting us off,'" Kellum says.

But Kellum has some advice for the disgruntled: Get smaller boats so you can compete with North Carolina boats.

Traveling fishermen also must deal with the pressures of being away from their families for weeks, sometimes months, at a time.

Forest Williams

"It's tough being away and staying on a boat," Brooks says. "I'd rather stay at home."

Daniels' crew on the "Venus" may be away from home for as much as a month at a time. They keep in touch with their families in Wanchese via a cellular phone on the boat. And their wives may drive or fly up for a visit every now and then.

Williams admits, "It's a hard way to make a living."

But his crew members manage to get home as often as possible—usually every 10 to 15 days, he says.

Williams says he's heard the wives of his crew members say, "I'm glad he's gone. I was getting tired of him."

But the next day, the phone is ringing. "When is he going to be back in?" they ask.

"It's a honeymoon all over again when they come back in," Williams says.

Kellum says the months away from home are wearing on him, and he's considering moving to South Carolina for good. Oysters and clams are getting scarce in Core Sound, he says. And he figures he can make enough money just shrimping in South Carolina.

But for Williams, moving is not a choice. "I've got six kids in school, and this is my home," he says.

High prices and strong demand for shrimp draw fishermen away from home

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

If you're fishing for something fun to do this summer, consider North Carolina State University's 37th annual Sport Fishing School. Sponsored by the Department of Zoology and the Division for Lifelong Education, the school will be held June 12 through 17 in Hatteras. It is designed for folks who want to learn more about fishing for offshore big game fish. You'll cruise the Gulf Stream for blue marlin, dolphin, wahoo and tuna. And you'll learn about fishing in the surf, sounds and inlets.

The school is open to anyone, but registration is limited. Children under 16 must be accompanied by an adult registrant. The cost for the five-day course is $600. The fee covers classroom and surf instruction, boat charters for two all-day Gulf Stream trips, bait and a fish fry. Lodging is not included. For more information, contact Alice Strickland Warren at the NCSU Division for Lifelong Education, Box 7401, Raleigh, N.C. 27695-7401.

In February, more than 200 people attended Sea Grant's conference on growing hard clams. Participants, including commercial fishermen, aquaculturists, scientists and resource managers, came from as far away as Maine and Florida.

Financial support for the conference was provided in part by the N.C. Biotechnology Center, the Gulf and South Atlantic Fisheries Development Foundation and the Mid-Atlantic Fisheries Development Foundation.

If you weren't able to attend the conference, but would like information on growing clams, contact Sea Grant advisory agent Skip Kemp at 919/247-4007.

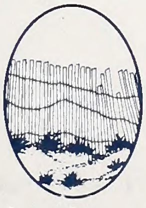
Joyce Taylor, Sea Grant's seafood education specialist, has produced another brochure in her seafood series. *Flaking Fish* describes how to make the flakes by poaching or steaming the fish, then flaking the meat away from the bone for use in other dishes.

Fish flakes provide additional ways to enjoy the nutritional benefits of seafoods. They are high in protein, but low in fat, calories, cholesterol and sodium.

You can use fish flakes as the primary ingredient in dishes such as salads and chowders or as an extender in preparations such as deviled crab.

For a copy of *Flaking Fish*, write Sea Grant. Ask for UNC-SG-87-05. The cost is 50 cents.

You also can order copies of the other brochures in the series: *Hooked on Fresh Fish and Shellfish*, UNC-SG-85-08; *Dressing Finfish*, UNC-SG-86-10; and *Bringing the Catch Home*, UNC-SG-86-26. The cost for each of the brochures is 50 cents.



Last year, severe erosion forced several South Nags Head homeowners to pick up and move. Literally. They had to take their belongings . . . and their oceanfront houses . . . to safer inland lots.

Such a move costs from $15,000 to $30,000. And until recently, homeowners had to pay every penny.

In December, Congress passed new legislation that changed all that.

The National Flood Insurance Program previously only reimbursed insured homeowners for actual damages to a building from erosion, says Spencer Rogers, Sea Grant's coastal engineer. Now the law grants insurees two new options in dealing with erosion's threats.

If a structure damaged by erosion cannot be saved, homeowners can receive up to 110 percent of its insured value to cover cleanup or demolition costs.

Homeowners who want to move houses from threatened areas will be eligible for payments of up to 40 percent of the total value of the building or 40 percent of the building insurance coverage. To receive the benefits, homeowners must adhere to certain restrictions, including moving the house to a location behind the 30-year erosion setback line.

To qualify for coverage, threatened buildings must be built along an ocean or inlet shoreline or a "lake or other body of water."

For details of the new program, contact your insurance agent. Or write Spencer Rogers, Sea Grant, Box 130, Kure Beach, N.C. 28449. His number is 919/458-5780.

Dune plants are the soldiers of the botanical world. They protect the dunes as they fight to survive. In the summer, they face intense heat and sunlight. In the winter, they meet the cold. Year-round they withstand ocean waves, salt spray and constantly shifting sands.

These hardy plants help stabilize our dune systems. Their flowers and berries add beauty to the beach, and many provide food.

Discover these fascinating plants with the new book *A Guide to Ocean Dune Plants Common to North Carolina*. Author E. Jean Wilson Kraus, botanist and educator at the North Carolina Maritime Museum, introduces more than 75 species of grasses, vines, herbs, shrubs and trees found on our coastal dunes.

Detailed illustrations and descriptions of each plant, as well as accurate keys, help in identification.

Kraus also introduces the ocean

Continued on next page

dune environment and plant habitats and explains how plants survive the harsh conditions there.

This 80-page book is an excellent guide for botanists and beachgoers. And it is a helpful educational tool. *Ocean Dune Plants* was published by the University of North Carolina Press in collaboration with Sea Grant.

To order, send $4.50 to Sea Grant. Ask for publication number UNC-SG-87-01.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program , 105 1911 Building, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Vol. 15, No. 3, March 1988. Dr. B.J. Copeland, director. Kathy Hart, editor. Nancy Davis and Sarah Friday, staff writers.

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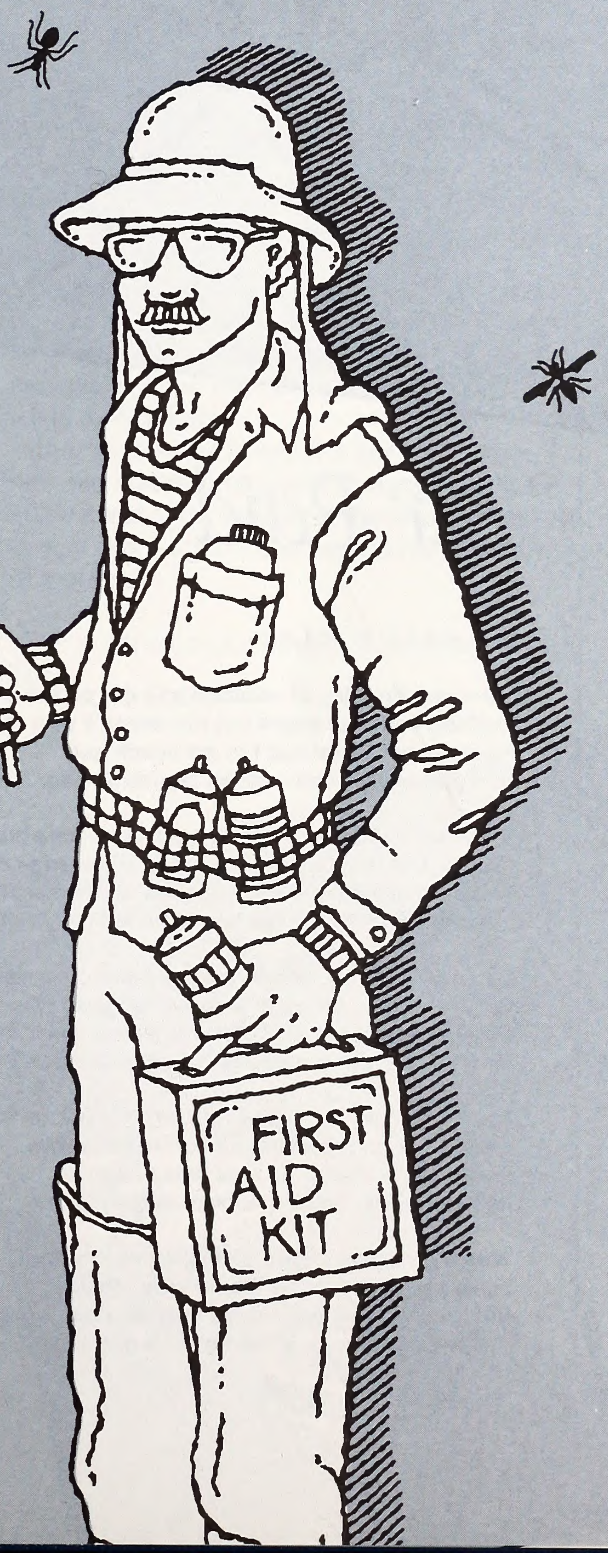


Mr. P.E.S.T.

(Perfectly Equipped Seaside Tourist)

Meet Mr. P.E.S.T. He's ready for every crawling fire ant, swimming jellyfish and flying mosquito that may come his way at the beach.

If you hate things that sting and bite as much as he does, you'll love this issue of *Coastwatch*. We've pinpointed most of the pests that might pester you on your vacation and offered a few tips for warding off their attacks and soothing their bites.

Air Raid

BY KATHY HART

'Twas the first day of vacation and out on the shore
Nothing could be heard but the ocean's own roar.
Mama in her bikini and I in my beach hat
Had just settled down for an afternoon nap.

When out by the salt marsh there arose such a buzzing,
I sprang from my lounge chair to see what was a-coming.
I hopped in my flip-flops, brushed off the sand,
Tossed off my beach hat and adjusted my Ray Bans.

When what to my wondering eyes should appear,
But a swarm of biting insects—enough to cause fear.
On deerflies, on greenheads, on biting sand fleas,
On four types of mosquitoes including *Culux* and *Aedes*.

As I drew in my head and was turning around
I felt the jaws of the first mosquito bite down.
Its eyes how beady, its legs how hairy,
Its long tubelike mouth looked terribly scary.

With a flick of my hand and spray of repellent
I drove away my blood-thirsty assailants.
But I heard them exclaim as they flew out of sight,
"Happy vacation to all and to all a good bite."

Whether resident or vacationer, everyone has suffered through a summer invasion of the coast's biting insects—mosquitoes, deerflies, greenhead flies, dog flies and no-see-ums.

And no matter how much repellent you spray, one mosquito or no-see-um always finds that tender unsprayed spot on the back of your leg to plant its jaws.

Before long, you're itching, scratching and rubbing on the analgesic salve.

It's enough to spoil your day.

Like it or not, the same refreshing salt water that attracts us to the coast also breeds blood-sucking pests.

From Morehead City south along the North Carolina coast, salt marsh mosquitoes, no-see-ums, greenhead flies and deerflies are abundant. From Morehead City north, it's salt marsh mosquitoes, greenheads and deerflies.

The pest season starts early. The first wave of mosquitoes usually swarms out of the salt marsh in mid-April. The flies and no-see-ums join the blood quest a month or so later.

Interestingly, it's the females of these flying pests that delight in drawing blood. They need a blood meal to produce their eggs. The males feed on plant juices instead.

About 50 species of mosquitoes inhabit our coast. But fortunately, only about one dozen of them attack people. Other mosquito species specifically draw blood from birds or from reptiles and amphibians.

Aedes, or salt marsh mosquitoes, have earned a reputation as the most abundant and tenacious mosquitoes to swarm our shores. They're a little larger than their mosquito cousins, more persistent in pursuing their prey and active from dawn until dusk in their quest.

Other mosquitoes seek their meals only during twilight hours.

The female salt marsh mosquito lays its eggs in moist soils that will eventually be inundated by tidal flows or rainwater. When the eggs are flooded, they hatch. Three weeks later, hungry adult mosquitoes emerge from the marsh in droves.

The average mosquito lives two to three weeks, and 90 percent of the females die after taking only one blood meal and laying their eggs, says Charles Apperson, an entomologist at North Carolina State University.

But some female mosquitoes do take blood from more than one human victim. That's how they spread some diseases.

In North Carolina, however, there are few human disease transmission problems from mosquitoes, says Barry Engber, a medical entomologist with the N.C. Department of Human Resources.

But mosquitoes do transmit some deadly diseases among animals. In particular, veterinarians warn that Fido should take heartworm prevention medication year-round in North Carolina.

Because mosquitoes pose some health threat and because they're such a nuisance, state and county health agencies try to control mosquito populations.

Some counties spray insecticides or bacterial larvicides.

In the past, the state did extensive ditching to drain the marsh. But they learned that was ineffective.

Now, they have a pilot project that calls for digging narrow channels in the marsh to unite the mosquito larvae and eggs with their natural predators—fish.

Although these efforts reduce overall populations, they can't guarantee you won't be bitten. You have to take some precautions of your own.

To ward off mosquitoes, no-see-ums and flies, Apperson recommends choosing a repellent that has the highest percentage of active ingredients. It should be effective for 30 minutes to several hours depending on the temperature and humidity.

An unofficial repellent commonly used by coastal residents is Avon Skin-So-Soft bath oil.* Engber says that a study has shown the bath oil is effective in driving off mosquitoes. And Apperson says it also repels no-see-ums.

Both entomologists speculate that the bath oil spreads a film on the skin that the pests find difficult to penetrate with their mouth parts.

Aside from swatting, repellents offer the only line of defense against no-see-ums, deerflies, greenheads and dog flies. These flying pests breed in such diverse wet areas that they are impossible to control with insecticides and larvicides.

In many areas, they're just as abundant and annoying as the mosquito. In fact, their bites are more painful, Apperson says.

Mosquitoes pierce the skin with a tiny tubelike mouth. People often don't even feel the bite.

But flies and no-see-ums have scissorlike mouths that lacerate the skin. They wait for the blood to come to skin's surface before slurping it up.

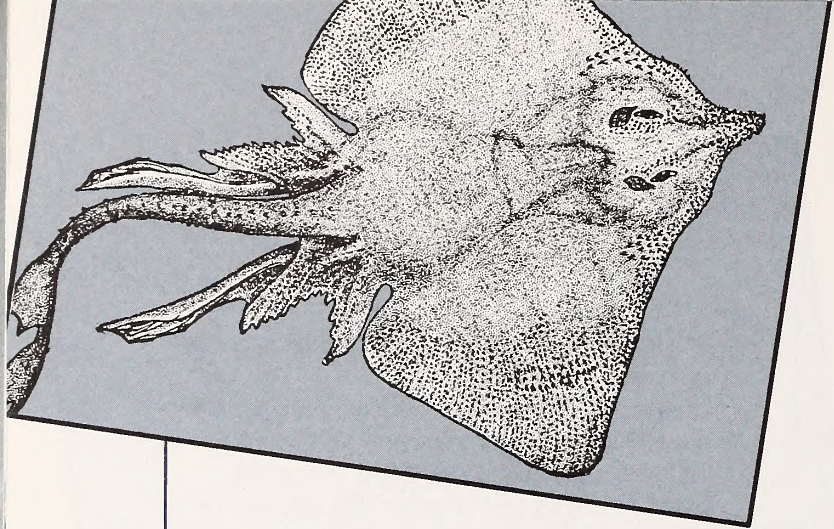
To keep no-see-ums out of your beach cottage, Apperson recommends turning off the lights at dusk and installing fine-mesh window screens.

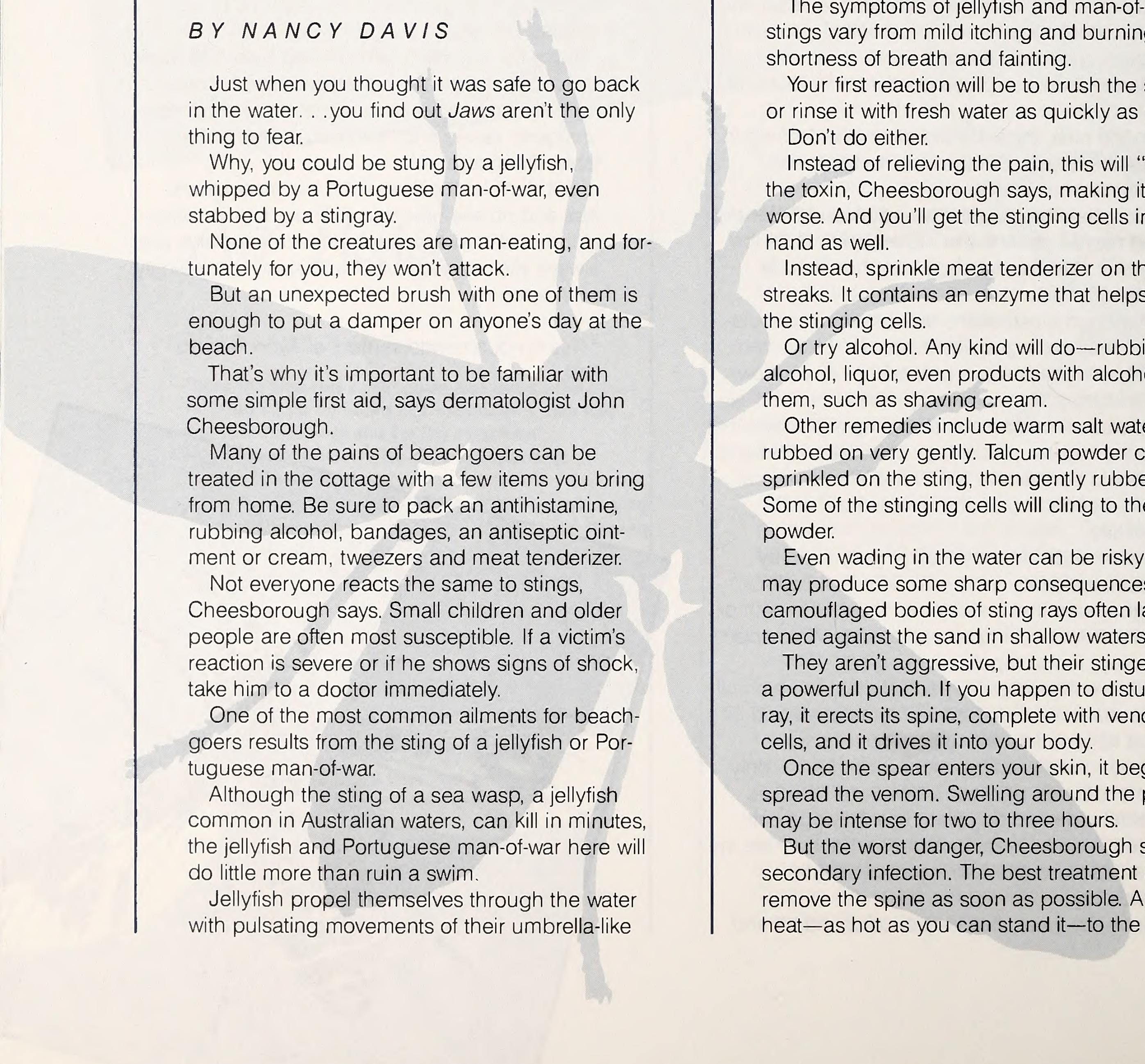
Although some beachgoers claim they are bitten by sand fleas, there is no such bug in North Carolina, Apperson says. Most likely, they are being bitten by regular fleas, no-see-ums or mosquitoes, he says.

If you've already been attacked by any of these blood-sucking pests, Apperson recommends rubbing the bite with any of the over-the-counter analgesic salves and taking an antihistamine tablet if necessary.

But don't let the threat of a few mosquitoes, flies and no-see-ums ruin your outdoor activities at the coast. Just remember these assailants are always after "a good bite," and spray accordingly with repellent.

*This is not an endorsement of Avon Skin-So-Soft.





Surprise Attack in the Surf

BY NANCY DAVIS

Just when you thought it was safe to go back in the water. . .you find out *Jaws* aren't the only thing to fear.

Why, you could be stung by a jellyfish, whipped by a Portuguese man-of-war, even stabbed by a stingray.

None of the creatures are man-eating, and fortunately for you, they won't attack.

But an unexpected brush with one of them is enough to put a damper on anyone's day at the beach.

That's why it's important to be familiar with some simple first aid, says dermatologist John Cheesborough.

Many of the pains of beachgoers can be treated in the cottage with a few items you bring from home. Be sure to pack an antihistamine, rubbing alcohol, bandages, an antiseptic ointment or cream, tweezers and meat tenderizer.

Not everyone reacts the same to stings, Cheesborough says. Small children and older people are often most susceptible. If a victim's reaction is severe or if he shows signs of shock, take him to a doctor immediately.

One of the most common ailments for beachgoers results from the sting of a jellyfish or Portuguese man-of-war.

Although the sting of a sea wasp, a jellyfish common in Australian waters, can kill in minutes, the jellyfish and Portuguese man-of-war here will do little more than ruin a swim.

Jellyfish propel themselves through the water with pulsating movements of their umbrella-like bodies. But they won't intentionally swim toward you.

The Portuguese man-of-war resembles the jellyfish, but is more translucent. It floats on top of the water, moving with the currents and breeze.

The tentacles of Portuguese men-of-war may be as long as 75 to 100 feet. They can inflict a nasty sting even after they've been severed from the body. Cheesborough says the stinging cells may remain viable for three weeks or longer.

If you have an encounter with a jellyfish or man-of-war, chances are you may not even see what got you. The only evidence may be a long streak or series of streaks on your body.

The symptoms of jellyfish and man-of-war stings vary from mild itching and burning to shortness of breath and fainting.

Your first reaction will be to brush the sting off or rinse it with fresh water as quickly as you can.

Don't do either.

Instead of relieving the pain, this will "fire off" the toxin, Cheesborough says, making it even worse. And you'll get the stinging cells in your hand as well.

Instead, sprinkle meat tenderizer on the streaks. It contains an enzyme that helps detoxify the stinging cells.

Or try alcohol. Any kind will do—rubbing alcohol, liquor, even products with alcohol in them, such as shaving cream.

Other remedies include warm salt water rubbed on very gently. Talcum powder can be sprinkled on the sting, then gently rubbed off. Some of the stinging cells will cling to the powder.

Even wading in the water can be risky and may produce some sharp consequences. The camouflaged bodies of sting rays often lay flattened against the sand in shallow waters.

They aren't aggressive, but their stingers pack a powerful punch. If you happen to disturb the ray, it erects its spine, complete with venomous cells, and it drives it into your body.

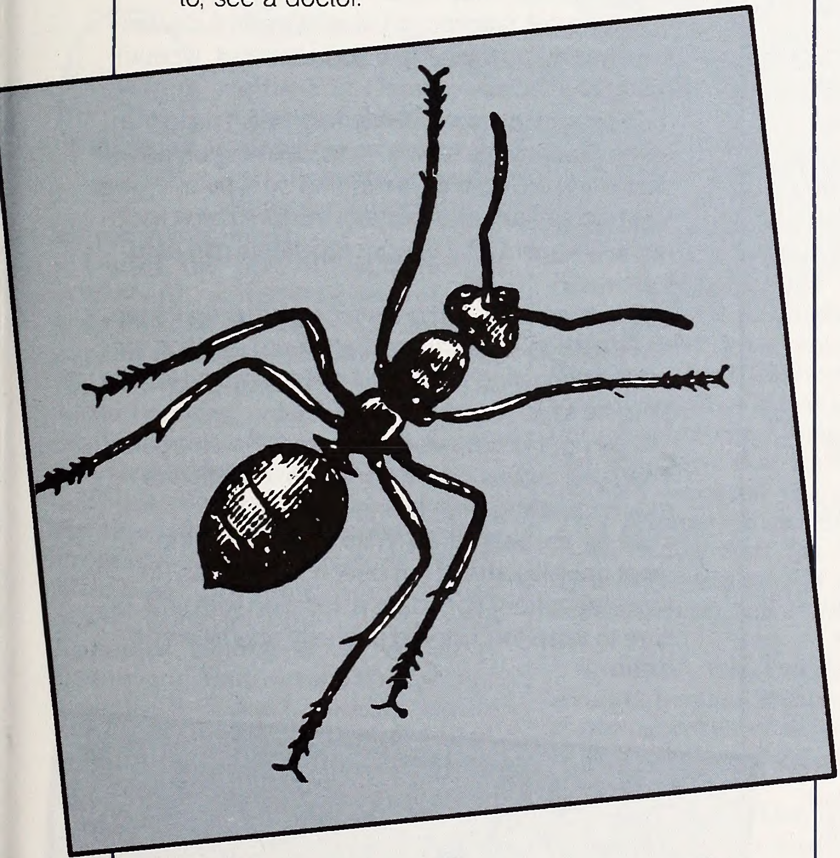
Once the spear enters your skin, it begins to spread the venom. Swelling around the puncture may be intense for two to three hours.

But the worst danger, Cheesborough says, is secondary infection. The best treatment is to remove the spine as soon as possible. Apply heat—as hot as you can stand it—to the wound to break down the venom. Then see a doctor for an antibiotic to ward off infection.

Treat puncture wounds from sea urchins and fish spines in the same way, Cheesborough says.

Other water hazards include a variety of skin conditions that may come from the water, Cheesborough says. They may be caused by crab larvae, seaweeds and some algaes, he says. These can usually be treated with calamine lotion, creams and antihistamines.

The bottom line, Cheesborough says, is not to let a minor sting ruin your vacation. If it threatens to, see a doctor.



Ground Assault

BY SARAH FRIDAY

"He followed me home. Can I keep him?" pleads a wide-eyed little ant with a furry friend in a popular cartoon.

The even wider-eyed parents say nothing as they look up in horror at the pet trailing their innocent son.

It's an anteater.

Gary Larson's *Far Side* funnies have done wonders for the public's image of the common bug.

But when it comes to the real thing, most beachgoers don't think any insect is a laughing matter.

They cringe at the thought of roaches in their cottages, or fire ants crawling up their legs. They shiver at chiggers and twitch at ticks.

But like a picnic without ants, what would a beach trip in the summer be without bugs? They are part of it, invited or not.

Besides the pests that fly through the air and swim in the sea, the ones that crawl in the ground make trouble, too.

Ask Ray Harris of Morehead City.

As director of Carteret County's Agricultural Extension Service and an area pest expert, Harris has spent years helping people stomp out their bug problems.

The job isn't easy, Harris says, especially with fire ants.

The small, reddish brown ants seem to be everywhere, he says. They build their mounds on the beach, along the road, in the woods or wherever they please.

You can usually recognize the mounds because they're large and made of dirt. Some are up to 3 feet tall.

To be sure the mound is for fire ants, stomp your feet nearby, suggests Clayton Feltman of the New Hanover County Health Department. "If you see a multitude of them coming out, the best thing to do is just stay away from them."

"If you step on a mound," Harris says, "they'll start climbing up your leg. If you stick a stick in the mound, they'll start climbing up the stick."

Fire ants are aggressive. And they bite. Most people say the bite is like a bee sting, but with a fiery pain.

Reactions vary. Usually a bright red welt forms that itches and burns, Harris says. But some people may have an allergic reaction and need to see a doctor.

Harris recommends soothing the pain with a meat tenderizer. Others suggest ice and an antiseptic.

Ground Assault CONTINUED

If you can treat the bite within 30 minutes, household ammonia can counteract the acid in your skin, says Wilmington pharmacist Hal King. After that, he recommends using an antihistamine.

Treating a fire ant's mound takes a different prescription.

A fire ant colony operates much like a bee colony, with a queen ant in charge. She burrows 3 to 4 feet in the ground and has thousands of worker ants to serve her. To destroy the mound, you must kill the queen.

Gas and dry chemical treatments work, but liquid chemical applications do the job best, Harris says. Check with a county agent or vector control specialist for more information.

Vacationers in Manteo will be glad to know that fire ants haven't traveled that far north yet. But like the rest of the coast, the area has plenty of ticks and chiggers.

Before you put away your beach blanket, read on.

"Ticks are more of a nuisance than anything," says Chris Wise, a Dare County extension agent.

"Basically they are pests," Wise says. They get on your skin and walk around. Sometimes the females decide to bite you and stick their sucking parts into your skin, he adds.

Try to determine if the tick is attached or not before you try to remove it, Wise advises. Either the tick will be stuck or the skin around it will be red.

If the tick is not attached, pull it off carefully and burn it with a match or gas, or drown it in oil.

If it's embedded, first try to pull it off gently with tweezers, Wise says. If that doesn't work, rub oil or petroleum jelly over the tick. That will suffocate it and make it back out.

Always clean your hands and the area where the tick was, then use an antiseptic, Wise says.

The chance of getting Rocky Mountain spotted fever or Lyme disease from a tick is small, he says. But be aware of ticks. If one has been embedded for a long time and you get sick, see a doctor.

The agent's best advice concerning ticks is to initially prevent them from attaching. Repellents are available. But Wise suggests wearing high-top shoes and trousers in wooded areas. And he advocates checking your skin and hair thoroughly and regularly if you've been in areas where there might be ticks.

The beaches are relatively tick-free, but watch out in the vegetated areas. Coastal pharmacists say most of the people who ask about ticks are hunters or campers.

The same goes for chiggers, or red bugs.

The tiny, bright red mite lives mostly in berry patches, woodlands and pine straw, not in the sand or grass, Wise says.

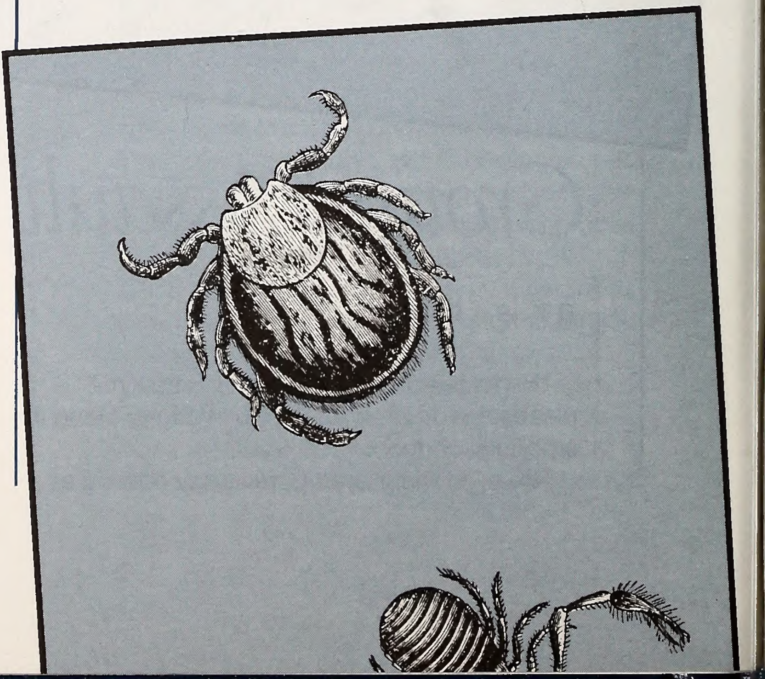
An allergic reaction to the mite's saliva causes the swelling and itching. If you scratch it, it could become infected.

To prevent chiggers, Wise suggests taking the same precautions as with ticks. Wilmington pharmacist Mike Costin says rubbing on a pine-scented cleaner or an extract mixture helps keep some chiggers off. Chigger repellents can help, too.

Pharmacist Hal King discourages using fingernail polish to kill chiggers. Petroleum jelly has the same suffocating effect and is less harmful to your skin, he says.

If you get bitten, wash or pull off the chiggers. Then use topical creams or calamine lotion to reduce swelling and itching.

As far as roaches go, Wise says they're the most troublesome at the beach in cottages. To keep them from spending a vacation with you, be sure to keep food stored properly and all areas clean.



THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

UNC Sea Grant, the N.C. Coastal Federation and the N.C. Department of Public Education are organizing a series of workshops about coastal regulatory agencies and citizen involvement.

During the first of the two-night workshops, representatives from the state's coastal regulatory agencies will explain the regulations and processes for managing coastal resources. The second evening, workshop leaders will explain how citizens can become involved in the regulatory process.

The workshops are sponsored by the Albemarle-Pamlico Estuarine Study Program and will be held: May 18-19, Municipal Building, South Broad Street, Edenton; June 1-2, St. Peters Episcopal Church at the corner of Bonner and Main streets, Washington; June 15-16, Duke University Marine Laboratory auditorium, Beaufort; July 20-21, St. Andrews Episcopal Church By-the-Sea, Virginia Dare Trail, Nags Head.

In addition, participants in the workshops will be eligible to attend one of the two Saturday field trips planned for 10 a.m. to 3 p.m. Aug. 6 at N.C. Aquarium on Roanoke Island and Aug. 13 at the aquarium at Pine Knoll Shores.

The workshops are free and open to the public. No preregistration is required. If you have questions, call the Coastal Federation at 919/393-8185.

To increase the awareness of the Albemarle-Pamlico estuarine ecosystem, biology and social studies teachers from target schools in Northeast North Carolina will be selected to participate in the citizen awareness workshops.

Wende Allen, a regional science coordinator for N.C. Department of Public Education, is coordinating the teachers' selection. She wants to increase the educators' awareness of the Albemarle-Pamlico Estuarine Study, the ecology of the area, the regulatory system that manages it and the role citizens can play in management.

Teachers or principals who are interested should contact Allen at the Northeast Regional Education Center in Williamston at 919/792-5166.

In conjunction with the workshops, Sea Grant and the N.C. Coastal Federation have produced a 70-page booklet, *A Citizen's Guide to Coastal Water Resource Management.*

If you are interested in the development and preservation of North Carolina's coast, this booklet is a must-read. It describes in everyday language the complex combination of federal and state laws that form the basis of the state's coastal resource management program, including the federal Clean Water Act, the N.C. Coastal Area Management Act and the N.C. Sedimentation and Pollution Control Act.

And the booklet explains how citizens can become involved in forming, changing and enforcing resource management rules, regulations and decisions.

The booklet, which was funded by the Albemarle-Pamlico Estuarine Study Program, will be distributed at the workshops. For those who can't attend, write Sea Grant for a copy. Ask for UNC-SG-88-05, and please enclose $1 for postage and handling. Or to avoid the handling fee, stop by one of the Sea Grant offices located at the N.C. Aquariums at Fort Fisher, Pine Knoll Shores and Roanoke Island for a copy.

What's in season at the seafood counter? Well, if you had a copy of Sea Grant's seafood availability poster, you could find out in one quick glance.

The colorful 17-by-23 inch poster is a guide for buying fresh fish and shellfish. It graphically depicts when you're likely to find the 23 most common species in North Carolina. The chart is based on the state's commercial landing statistics.

For your copy of the poster, write Sea Grant. Ask for UNC-SG-84-04. The cost is $2.

If you've ever bought shrimp at the market, you know the prices can soar. But suppose you had your own supply of the tasty crustaceans?

That's right. With a little effort, luck, a license and a copy of Sea Grant's *A Guide to Recreational Shrimping*, you can fill your freezer with America's favorite seafood.

A Guide to Recreational Shrimping provides detailed instructions for rigging small boats to catch shrimp. It includes information on building doors, choosing nets, rigging the boat and pulling the net.

The 32-page booklet, written by Sea Grant advisory agent Wayne Wescott, provides valuable information about shrimp biology, regulations and types of trawl nets.

With the help of detailed illustrations, Wescott describes how to rig the net, prepare the boat and complete a successful tow. He offers many tips that can save the new shrimper hours of frustrations. And he has suggestions for culling and storing the catch.

For a copy of the booklet, write Sea Grant. Ask for UNC-SG-86-07. The cost is $4.

Sea Grant is cosponsoring a symposium on coastal water resources May 22 to 25 in Wilmington, N.C.

The four-day symposium will include sessions on a variety of topics from wetlands protection to waste disposal in coastal areas.

Sea Grant Director B.J. Copeland

Continued on next page

will moderate a session on estuarine water quality. And Sea Grant researchers Donald Stanley, Joseph Boyer, Kerry Smith and Wayne Skaggs will present the findings of their research.

For more information about the symposium, contact David Moreau, Water Resources Research Institute, Box 7912, NCSU, Raleigh, N.C. 27695-7912. Or call 919/737-2815.

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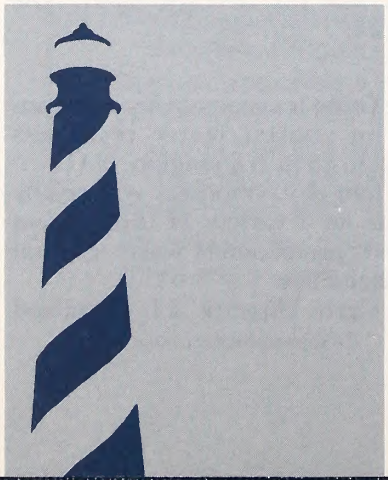

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COASTWATCH

Photo by Scott Taylor

North Carolina's Vanishing Maritime Forests

What sets these woods apart

BY KATHY HART

There's an old adage: "You can't see the forest for the trees."

In the case of North Carolina's maritime forests, that adage can be taken literally.

As you ride along N.C. 12 through Buxton or N.C. 58 past Bogue Banks, you see the gnarled branches of live oaks or the berry-laden limbs of yaupons along the side of the road.

But the branches of the oaks and yaupons rarely give you a glimpse of the forest beyond. And they certainly don't give you a clue to the importance of these maritime woodlands.

Oceanfront forests are special.

Their flora can grow where no trees and shrubs have grown before. They are specifically adapted to tolerate salt spray, strong winds and the poor soils of the barrier islands.

Despite this inhospitable environment, maritime forests provide barrier islands with special benefits. They anchor shifting sands; accumulate, store and protect fresh water; and add soil through decomposition of plants.

Today, North Carolina's barrier islands support diminishing numbers of acres of maritime trees and shrubs.

The larger forests are at Buxton, Kitty Hawk, Nags Head and the Smith Island Complex (Bald Head, Middle and Bluff islands). Smaller wooded tracts can be found on Currituck Banks, Ocracoke, Portsmouth Island, Shackleford Banks, Bogue Island, Topsail Island, Bear Island and Carolina/Kure Beach.

Portions of these wooded tracts are protected.

Nearly 300 acres of Nags Head Woods are owned by the N.C. Nature Conservancy. Another 260 acres are owned by the town of Nags Head to protect its groundwater supply.

The Cape Hatteras National Seashore manages 1,000 acres of the 3,000-acre Buxton Woods tract. The N.C. Division of Coastal Management recently bought another 328 acres as part of its Coastal Reserve Program.

The Cape Lookout National Seashore maintains the woodlands on Portsmouth and Shackleford Banks.

And the state owns a 256-acre maritime forest on Bogue Banks, the Theodore Roosevelt State Natural Area, and the forests on Bear and Bluff islands.

Photo by Scott Taylor

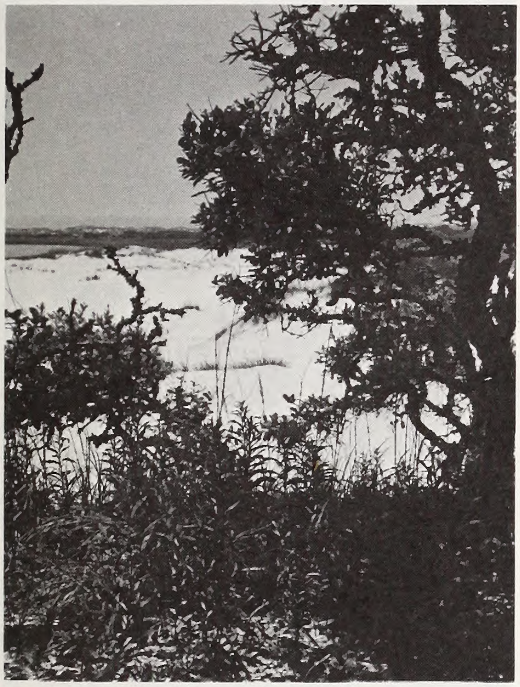


Photo by Scott Taylor

But this is only partial protection. As developers eye these maritime woodlands as possible sites for condominiums, hotels and housing projects, resource managers, conservationists and scientists worry. They would like to see these valuable maritime forests protected, preserved and studied.

"People don't know how important these systems are ecologically," says Jonathan Evans, a barrier island plant ecologist at the Duke University Marine Laboratory. "They associate the forests with mosquitoes and bugs.

"It's like the salt marshes. Twenty years ago most people considered them wastelands," he says. "Now they realize how vital they are."

Evans says the maritime forests stabilize the otherwise unstable barrier islands more than any other plant community.

The forests grow on old dune systems called relic dunes. And they are populated by species of vegetation—live oak, red cedar, yaupon and wax myrtle—that can adapt to the harsh seaside conditions.

The salt spray constantly shears and shapes the trees and shrubs. The salty deposits kill outer twig shoots but allow growth along the inner branches, says Lundie Spence, Sea Grant's marine education specialist. The result is a thick, tightknit forest canopy that provides protection for less salt-tolerant species such as dogwood, red maple and American hornbean.

But as deadly as the salt spray is to outer branches, it is vital to the growth of the forest, Spence says. Minerals and trace elements carried in the sea breeze fertilize the sand and vegetation. Without the airborne ocean broth, the maritime forest would lack essential growth nutrients.

And just as the forest canopy regulates the infiltration of salt spray, it also manages the conservation of rainfall.

The canopy shields out the sun's evaporating rays, providing protection for the layer of fresh water that lies just beneath the land's surface. The layer is fed only by rainfall, and it is the sole source of fresh water along much of the Outer Banks.

By conserving water, the maritime woodlands also store water for the barrier island residents and vacationers who want a shower in the morning or a glass of water with their meals.

And the seaside timberlands provide other vital functions. They trap and moor sand, gradually add soil to barrier islands threatened by sea level rise and offer refuge to an array of wildlife.

But development threatens all of the maritime forest's valuable functions, Evans says. Building houses, condos or motels in these woodlands would fragment the forest, destroy its natural defenses and allow the killing salt spray to penetrate.

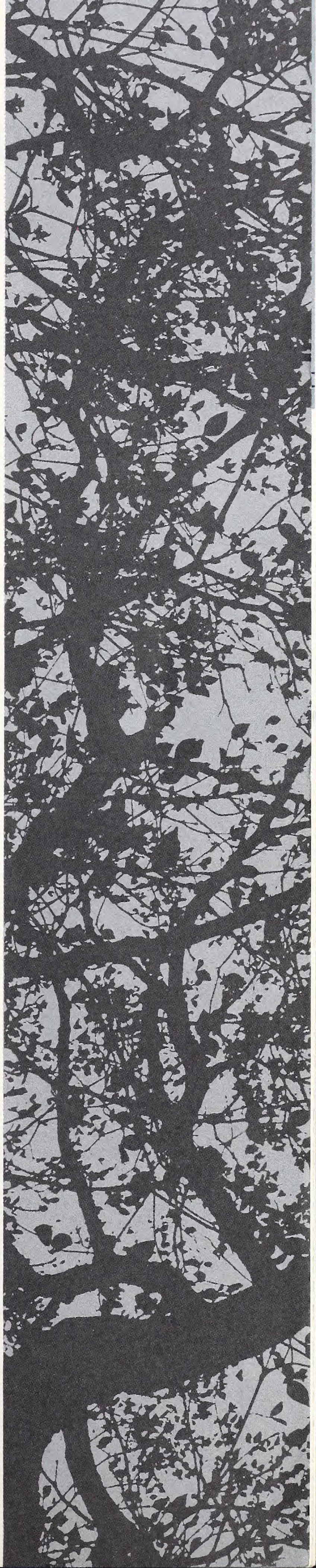
Eventually the forest could die.

Scientists don't know how much fragmentation the maritime forests can withstand and still work as a whole. And coming up with the magic number of acres for preservation or conservation is hard, Evans says.

"The amount of acreage needed for aquifer protection is different from the amount needed to sustain a deer population," he says.

In Evans' eyes, a combination of research, preservation and public interaction is needed to protect seaside timberlands.

"The public needs to recognize and understand how important our maritime forests are and then apply pressure to preserve them," he says. "But if they don't realize their significance soon, they could be destroyed."



The struggle to save our maritime forests

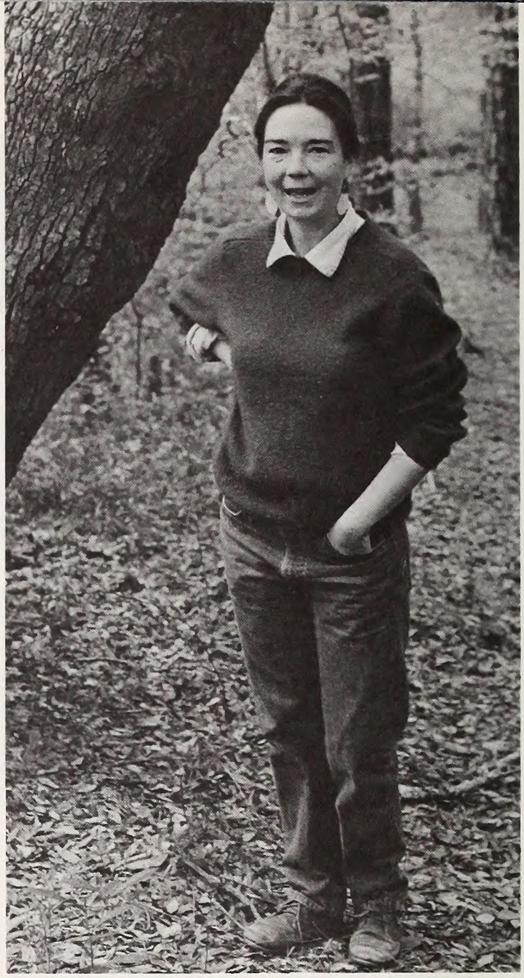


Photo by Nancy Davis

SHAY CLANTON IN BUXTON WOODS

BY NANCY DAVIS

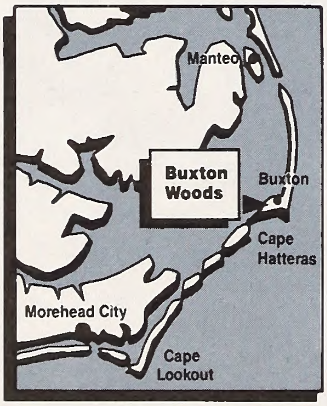
A rope swing drifted some 25 feet beneath a gnarled live oak branch.

Shay Clanton took a running jump and threw her legs around the swing's seat. She sailed through the trees several times, then dropped off.

The clearing would make a beautiful site for a house. But Clanton felt more at home with the rope swing. For the artist, development would only mar the landscape she loved to paint.

Clanton and about 250 environmentalists, all members of Friends of Hatteras Island, had just won a victory of sorts. After two years of debate and negotiation, the woods were to be protected by a special Dare County ordinance.

Development would still take place. But at least it would be controlled.



Buxton Woods, the state's largest remaining maritime forest, covers about 3,000 acres of the widest portion of Hatteras Island. About 1,000 acres are part of the Cape Hatteras National Seashore. Most of the remaining 2,000 acres are privately owned.

Except for a few houses, the woods have remained undeveloped . . . until now.

As beachfront land becomes scarce and prices soar, people are looking to the woods. And for some longtime property owners, the promise of hefty profits is luring them to sell their land or develop it themselves.

It's a scenario repeated up and down the Carolina coast. At one time, most of the Outer Banks were forested with the live oak, laurel oak and loblolly pine characteristic of maritime forests.

But time has taken its toll. Many of the forests have been chopped by the developer's ax.

Buxton Woods is just one of the state's maritime forests that's been under scrutiny lately. And the debate over that forest has called attention to others from Duck Woods to Bald Head Island.

"Maritime forests are already an endangered habitat," says David Owens, director of the N.C. Division of Coastal Management.

"Most of what we had is gone, and most of what we have left is going," he says.

And it's the going that has Clanton and her group worried.

"We don't oppose development in here," she says of Buxton Woods. "It's just such a fragile place that we're afraid large-scale development would destroy it.

"Everyone realizes that development is inevitable, but we hope it's planned enough that it won't destroy the environment," Clanton says.

The controversy over Buxton Woods began in 1986 when a landowner announced plans for a golf course and housing development. Individual homes had been built in the forest before, but never a large development.

The Friends of Hatteras Island formed in opposition to the proposed development and began a two-year lobbying effort to save the woods.

At the same time, the N.C. Sierra Club asked the N.C. Coastal Resources Commission to designate the woods an area of environmental concern. The AEC designation would have required special state permits for development in the woods.

Some areas, such as wetlands, estuarine shorelines and coastal beaches, are automatically designated AECs. Others must be nominated and must meet certain criteria to qualify.

Opposition to Buxton Woods development centered on concern for the water supply. Critics feared development would lead to contamination or depletion of the freshwater aquifer that serves as Hatteras Island's main source of drinking water.

In lieu of the state's AEC designation, in March the Dare County Board of Commissioners passed its own zoning ordinance to protect the area.

Ray Sturza, Dare County planning director, says the county's approach to the preservation of the woods was much like the state's proposed AEC designation.

The commissioners recommended that as much of the woods as possible be acquired by the state for preservation.

And they proposed that areas not acquired be managed by the local government through a special environmental zoning district.

The SED mandates a minimum lot size of roughly one acre per house and restricts the land to single-family residential use. It also calls for regular monitoring of water quality in the woods.

The state AEC, on the other hand, would have required lot sizes of nearly two acres.

Owens says the Coastal Resources Commission was satisfied that the county's plan would provide adequate protection for the woods.

If the commission feels the county isn't enforcing its ordinance, it reserves the right to resurrect the AEC proposal. But even with the SED, Owens says the ultimate protection for Buxton Woods and other maritime forests is state acquisition. After all, zoning ordinances can be changed, and such decisions are always political, he says.

So, even though Dare County now controls development in the woods, Owens continues to negotiate with landowners to purchase parcels for the state.

So far, he's bought 328 acres.

The land will be included in the state's Coastal Reserve Program. It will be kept in its natural state for research and education, Owens says.

Without ownership of large chunks of the forest, the state is in danger of losing its maritime forests before it knows much about them, Owens says.

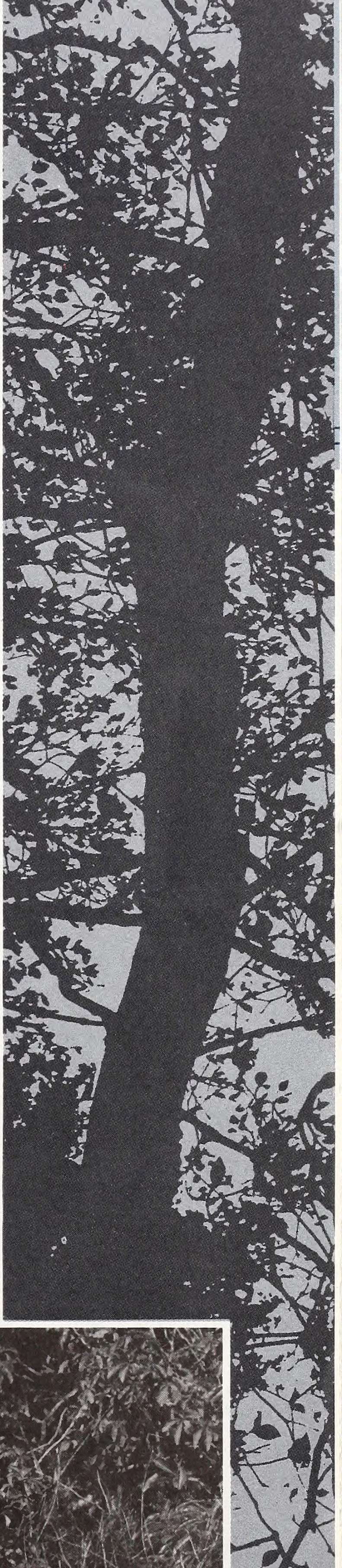
To learn more about the forests, Coastal Management funded a survey of all maritime forests larger than 20 acres. Jonathan Evans, the principal investigator and a researcher at Duke University Marine Laboratory, says he'll recommend the state conserve as much of the remaining maritime forests as possible. Evans would like to see all maritime forests designated as AECs so that the state would have some control over development in the areas.

"To have the communities disappear before we've had time to study them would be rather sad," Evans says.

Owens agrees. As he surveys an aerial photograph of Buxton Woods, he proudly points to the parcel of land recently acquired by the state.

"We now own the area where the golf course was proposed," he says.

And even though Buxton Woods is zoned for low-density development, it still disturbs Owens. "At what point does the development become houses in the woods or a subdivision with trees?" he asks.



JONATHAN EVANS

Photo by Scott Taylor

A friend in the woods

BY KATHY HART

Marcia Lyons shifts into four-wheel drive as she forces her vehicle up a steep incline on a narrow sand path in Buxton Woods.

Talking over her shoulder, Lyons explains the reason for the roller coaster ride: "Buxton Woods grew up on an old dune system. So, the forest alternates between ridges and low spots. Some of the ridges reach as high as 60 feet."

Lyons knows Buxton Woods well.

For her, the twisted limbs of the live oak and the spindly trunks of the loblolly pine are home and office.

She and her family live beneath the protective canopy of the Buxton woodlands. And as a park naturalist, she shares custodial duties for the 1,000 acres of the forest managed by the Cape Hatteras National Seashore.

But for Lyons, Buxton Woods is more than duty; it's a love.

She enjoys nothing better than telling folks about the plants and trees that knit together to form this tightly woven seaside forest.

Pointing out the window to the trees beyond, Lyons explains that the dominant forest species are the live oak, laurel oak and loblolly pine.

Lyons says the woods were logged during the 1700s and 1800s. First the live oak and red cedar were cut for shipbuilding. Then loggers turned to the pine and dogwood.

Meanwhile, Hatteras Island was also used for grazing cattle, horses, sheep, hogs and goats, she says. The goats, in particular, fed on the young tree and shrub shoots in the forest.

Finally, in the 1930s a penning law forced livestock owners to fence their animals. Afterward, the flora of Buxton Woods flourished abundantly.

Because of logging, grazing, occasional fires and hurricanes, Buxton Woods is a relatively young woodland, Lyons says. Most of the trees date back only 40 to 50 years.

Suddenly, Lyons brings the vehicle to a stop and points to a spike-leaved plant that resembles a fan.

"That's a dwarf palmetto," she exclaims. "Buxton Woods is the northern-most limit of its range. The same is true of the cherry laurel."

Hatteras Island is a transition zone between subtropical and cold-tolerant species. Winds off the nearby warm Gulf Stream encourage the subtropical plants to thrive, Lyons says.

The island's location and isolation have also led to unique subspecies of woodland creatures such as the eastern king snake. And when it comes to mammals, Buxton Woods has greater diversity than any other maritime forest in North Carolina or the adjacent states, Lyons proudly proclaims.

In fact, she's proud of every shrub, tree and vine in Buxton Woods. By telling people about them, Lyons hopes they will better understand, appreciate and perhaps preserve this special forest.

The car stops again, Lyons hops out and gazes across the "most scenic spot in the woods"—Jeanette's Sedge. Here in a low spot between ridges, fresh water oozes from the ground to form a marsh surrounded by lush vegetation.

She's right. It's beautiful...the kind of spot you want to show your kids 15 years from now and your grandchildren 15 years beyond that.

Lyons smiles. She knows she's made another friend for the forest.

JEANETTE'S SEDGE

Photo by Kathy Hart

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

Jim Bahen is a winner. Bahen, Sea Grant's Marine Advisory Service agent in the Wilmington area, recently garnered two prestigious extension awards.

The North Carolina State University Alumni Association presented Bahen with one of two Outstanding Extension Service Awards. At a banquet in Raleigh, Bahen was given a plaque and a $1,000 check to honor his marine extension efforts along the southeastern North Carolina coast.

Bahen was also named Agent of the Year by Sea Grant's Southeast Marine Advisory Service. Over 100 agents from North Carolina to Texas compete for this annual award.

Bahen's awards are based on his development of three successful extension programs: the Marine Weather Reporting Program, the Sea-Surface Temperature Program and the Turtle Excluder Device Program.

MAREP, a system for relaying weather reports via VHF radio between mariners and the National Weather Service, has increased the safety of an estimated 3,000 commercial and 6,000 recreational boats.

The Sea-Surface Temperature Program enables fishermen to save time and fuel by providing temperature data necessary for locating the warm Gulf Stream eddies and the fish that swim those waters.

With the TED program, Bahen introduced North Carolina shrimpers to the controversial excluder devices designed to allow endangered sea turtles to escape from shrimp nets. He also worked with Supply netmaker Steve Parrish to design a cheaper, easier-to-use TED that met federal approval.

Jim Murray, Sea Grant's MAS director, says, "Almost everyone involved in fishing in southeast North Carolina knows Jim and calls on him for objective information. He is friendly, courteous, dedicated and well-liked by his clientele group."

Bahen, who specializes in fishery information, has been with the UNC Sea Grant College Program for 10 years.

Olympic athletes aren't the only ones receiving medals this year. Sea Grant's writers recently won two medals in a national publications competition.

Coastwatch, Sea Grant's monthly newsletter, took top honors with a Gold Medal award from the Council for Advancement and Support of Education. Out of 65 entries in the newsletter publishing category, only four gold medals were awarded. Judges honored *Coastwatch* for excellence in writing, editing, design, photography and printing.

Coastwatch is written by Kathy Hart, Nancy Davis and Sarah Friday. Kathy Hart is editor. Each month, it is designed by Ginny Petty or Linda Noble, and printed by University Graphics in Raleigh.

Sea Grant's winning style also led to a Silver Medal award for *A Guide to Ocean Dune Plants Common to North Carolina*. The new book illustrating and describing the state's coastal flora was one of 40 entries in the book publishing category. CASE awarded four silver medals in this competition.

The guide was written and illustrated by E. Jean Wilson Kraus of the N.C. Maritime Museum and edited by Sea Grant's Sarah Friday.

If you'd like to savor sweet, succulent crab meat panned in butter or stuffed in a large fresh flounder, why not catch your own.

All you need is a crab pot and some chicken necks or fish heads for bait. The crab pot, which is easy to build, can trap 10 to 12 crabs in several hours during warm weather. And best of all, it doesn't need to be tended.

Sea Grant's *How to Build a Crab Pot* describes how to assemble the wire box that allows an easy entrance, but a difficult escape, for the blue crab.

It takes only galvanized wire, hog rings, pliers, wire cutters and about one hour of time to build, says Sea Grant agent Jim Bahen, author of the booklet.

For a copy of *How to Build a Crab Pot*, write UNC Sea Grant. Ask for UNC-SG-80-03. The cost is $1.50.

If you're planning to move and would like to continue receiving *Coastwatch*, please notify the Sea Grant communications office six to eight weeks in advance. And be sure to include your identification number, which appears just above your name on your address label.

The U.S. Postal Service notifies us of address changes, but only *after* you have moved and at a cost of 25 cents per return copy. We receive several hundred return copies per issue. These costs quickly add up and add a financial burden to a newsletter already strapped for funds.

So please do your part. Send us your address changes, and help us keep *Coastwatch* a free newsletter.

Also, when you subscribe to our newsletter, please allow six to eight weeks to get your first issue. The reason? We're always working ahead. The mailing list of the June/July issue, for example, was updated and printed in late May.

There are 18,000 of you on our mailing list, and we try our best to keep you all happy. But if you have a problem receiving your newsletter, please contact us. Write Sea Grant Communications, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Or call 919/737-2454.

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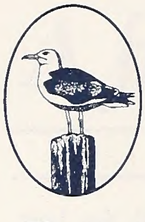

It's never too early to plan a trip to the beach. Mark Sept. 24 on your calendar now and plan to join thousands of other folks for North Carolina's Beach Sweep '88.

The second annual cleanup will cover the beaches from Nags Head to Wilmington. Last year, more than 1,000 people bagged 14 tons of trash. Beach Sweep coordinators hope to top those figures this year. And it can happen with your help.

Round up some friends, a club or your class to help pick up trash from 9 a.m. to 1 p.m. on the 24th. Bags, data collection cards and pencils will be provided at sites along the coast.

Coastwatch will print the names of regional and volunteer coordinators in August. If you'd like to pitch in, check the list in the next issue.

Beach Sweep coordinators also are looking for companies that would like to donate supplies, drinks, snacks or funds for printing or educational materials. All donors will be recognized for their contributions. If your company would like to make a donation, call Sea Grant at 919/737-2454. Ask for Lundie Spence or Sarah Friday.

Beach Sweep is sponsored by Sea Grant, the Office of Marine Affairs, the divisions of Coastal Management and Parks and Recreation, and the state 4-H Clubs.

Sea Grant agent Skip Kemp helped a Massachusetts company install the first state-approved water-column clam nursery.

Aquaculture Research Corp. is working with Kemp and a Carteret County lease holder to test the idea of water-column nurseries in North Carolina. Three-millimeter clams supplied by the company were placed in off-bottom racks where they will grow until they reach a size that is large enough to "plant."

In other clam aquaculture efforts, Kemp has set up spawning demonstration equipment behind the N.C. Aquarium at Bogue Banks. The equipment includes a water-heat exchanger, a spawning table and larvae tanks.

If you'd like for Kemp to show you how to spawn clams or other shellfish, call him at 919/247-4007 for an appointment. Kemp has also set up a small nursery, oyster trays and demonstration beds to show interested clientele.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Vol. 15, No. 6, June/July 1988. Dr. B.J. Copeland, director. Kathy Hart, editor. Nancy Davis and Sarah Friday, staff writers.

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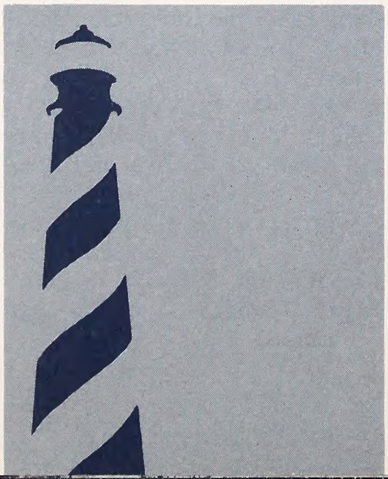

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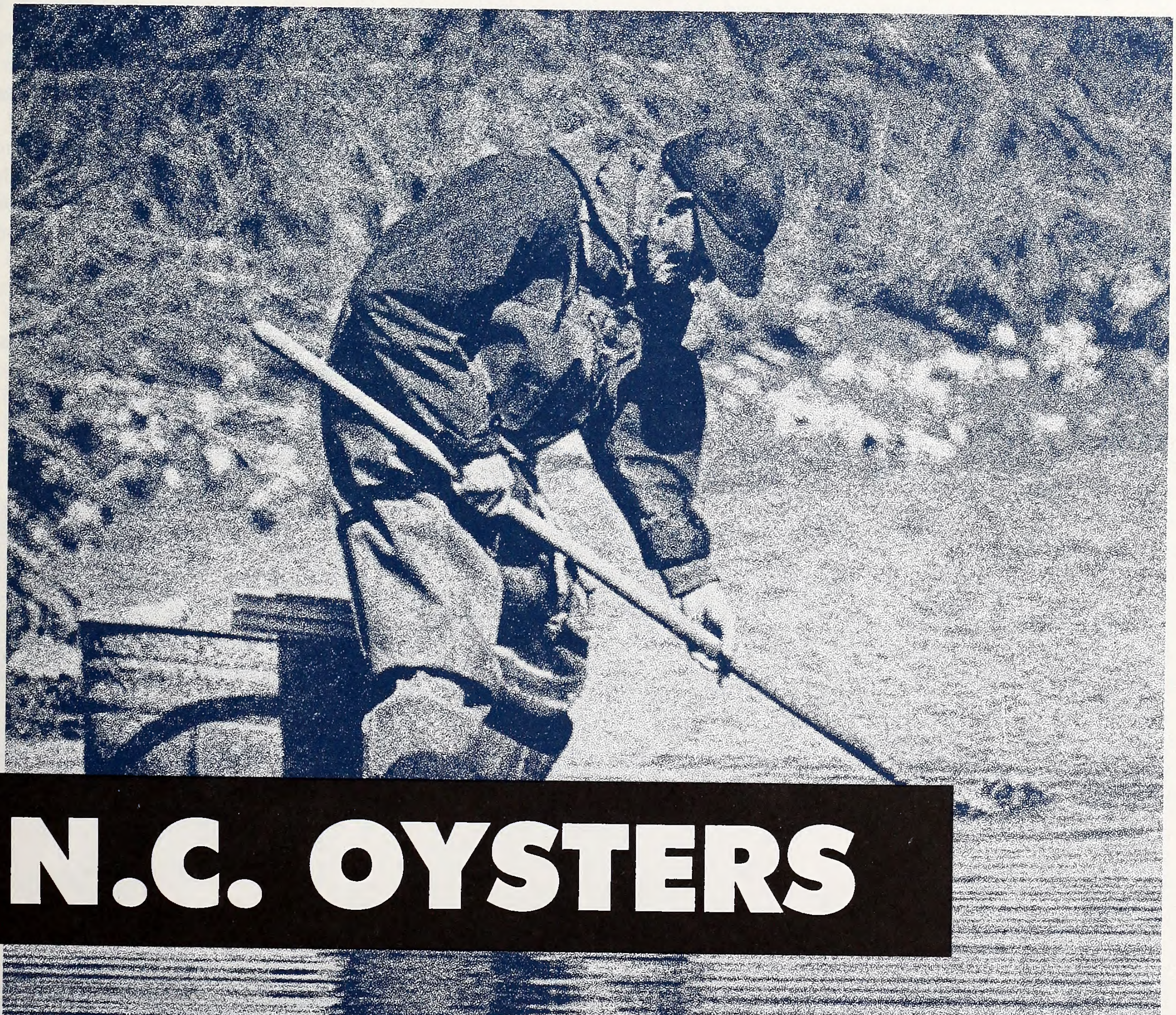

N.C. OYSTERS

Photo by Scott Taylor

DISEASE

Dermo and MSX, parasites that kill oysters, are leaving slim pickings for the state's oystermen.

Everything pointed toward a record harvest of oysters.

A year ago, the red tide had closed down most of the state's shellfish beds, leaving the oyster crop largely untouched. Fishermen reasoned that it would mean a bumper crop awaited their tongs this year.

But by early summer, well before the season opened, their hopes were dashed.

In the Newport River, clammers started noticing ''boxes'' in nearby oyster beds. The oysters were still hinged shut as though they were alive, but there was nothing inside.

And in Lockwood Folly River and Virginia Creek in Topsail Sound, the story was the same.

The oysters were dead.

Once plentiful beds were full of empty shells. Every now and then, a twist of the oyster knife revealed an animal inside. But more often than not, the mollusk was wasting away.

By November, the N.C. Division of Marine Fisheries confirmed the fishermen's worst fears.

The parasites that had decimated the once prolific oyster beds of the Chesapeake Bay had spread into Tar Heel waters. Dermo and MSX had shown up here.

Both are single-celled parasites, invisible to the human eye. They thrive in warm, salty waters typical of tidal creeks and sounds during drought conditions. The organisms attack oysters, eventually killing them.

DMF officials stress neither organism is harmful to humans, so shellfish beds will not be closed.

Of the two parasites, Dermo is the most prevalent here. In samples from the Newport River, 40 percent of the oysters contained Dermo. Lockwood Folly and Virginia Creek samples showed that nearly 85 percent of the oysters were affected with Dermo. The parasite has also been identified in Jones Bay in Pamlico County.

MSX has been identified in the Newport River, Wysocking Bay in Hyde County and the Crab Slough area near Oregon Inlet.

Until recently, it seemed North Carolina would escape the problems that have plagued our Northern neighbors since the 1950s.

So, when Maryland Sea Grant agent Don Webster heard Dermo and MSX had been identified here, he had four quick words. ''Oh, God help you,'' he said.

Oysters once dominated the seafood industry there. At one time, as many as 3,000 oystermen plied the waters of the Chesapeake Bay. Now fewer than 500 fishermen harvest the bivalves.

Photo by Scott Taylor

By Nancy Davis

STRIKES OYSTER CROP.

And Maryland, a state that once was the biggest supplier of oysters on the East Coast and claimed harvests of as much as 2.5 million bushels of oysters a year, now records about half a million bushels a year, Webster says.

In North Carolina, about 50 percent of the state's oyster crop is dead, estimates Mike Marshall, chief of DMF's Fisheries Development Section.

He attributes most of the oyster mortalities to Dermo.

Under normal circumstances, as much as 5 to 10 percent of the oysters die each year, Marshall says.

Last year, even though most of the shellfish beds were closed to red tide just a few weeks after opening, the state recorded one of its best harvests of oysters. Fishermen gathered 225,000 bushels of the bivalves at a value of $2.9 million, Marshall says.

Then, Marshall estimates an oysterman on the Newport River could bring in 15 to 18 bushels of oysters a day. This year, that same oysterman would be lucky to find three to five bushels, he says.

Continued on next page.

Newport River oystermen say as much as 90 percent of their oysters are dead.

Photo by Nancy Davis

Photo by Scott Taylor

Dermo and MSX attack the oyster, leaving only the shell.

Oysterman Raymond Graham agrees. Last year he harvested 25 bushels of oysters from the Newport River before 10 a.m. on opening day for the harvest. This year, it took him five hours to come up with four bushels.

Newport River oystermen say the mortality figures for their area are much higher than the estimated state figure of 50 percent. They believe more than 90 percent of the oyster crop there is dead.

As proof, on a recent December morning, Mill Creek fisherman David Oglesby pulled up a tongful of oyster shells from public bottom in the Newport River. Only two oysters were alive; the rest were empty shells.

Marshall says this may not be the first time Dermo has struck oyster beds in the Newport River. He believes the state has had outbreaks of Dermo before, but it simply wasn't identified. In 1981, for example, large numbers of oysters in the river died. Then, the mortalities were attributed to environmental conditions.

And interestingly enough, Marshall says, those environmental conditions were the same conditions under which Dermo is thriving now. The hotter and saltier the water, the better for Dermo and MSX.

"Those situations would be tough on an oyster anyway," Marshall says. "The stress of that, coupled with the parasitic protozoan in the system, causes a lot of mortality."

In the Chesapeake Bay where Dermo and MSX have ravaged oyster beds, scientists agree that Dermo is more of a problem.

When it rains and salinities drop below 10 parts of salt per thousand parts of water, MSX is quickly eliminated, says Eugene Burreson, a biologist at the College of William and Mary's Virginia Institute of Marine Science.

"But Dermo doesn't get eliminated or killed," he says. "It just sits there and redevelops when salinities go back up."

"Dermo is much more of a long-term problem than MSX," Burreson says.

Scientists aren't sure how Dermo and MSX got into North Carolina waters. Some believe the parasites have always been present, just waiting for the right conditions.

Dermo has killed oysters in Atlantic and Gulf of Mexico waters. MSX has been recorded from Maine to Florida.

And although the two parasites cause similar results—death of oysters—they are very different organisms, Burreson says.

Dermo is a slow killer, Burreson says. Usually an oyster has to be infected with Dermo for a year to 18 months before mortalities begin to occur.

The mollusks probably ingest Dermo as they are filtering water for food. Eventually, the parasite spreads throughout the oyster's system, overwhelming it until it finally wastes away.

Burreson believes that since shellfish beds were closed last year because of red tide, the denser populations may have contributed to the spread of Dermo this year.

MSX deals a swifter blow to oysters, killing in five to six months.

But so far, facts about how MSX enters the oysters have eluded scientists.

MSX, or multinucleate sphere x for unknown, was first spotted in Delaware Bay in 1957. Because researchers couldn't identify it, they named it for its spherical shape and numerous nuclei.

Now, 30 years later, scientists are still baffled. They haven't been able to culture the parasite in a laboratory, and they still aren't sure how it attacks oysters.

Some scientists believe other marine animals may carry MSX and transfer it to oysters. But they haven't been able to identify the carriers.

At Rutgers University Shellfish Research Laboratory, researchers are breeding oysters that show some resistance to MSX, says biologist Susan Ford. The oysters are produced by selectively breeding survivors of MSX infections.

These oysters may offer some hope to fishermen with private leases.

But until researchers find more clues and answers about how to control Dermo and MSX, they say the only thing to do is hope for wetter weather.

By Sarah Friday Peters

GIVING OYSTERS A CLEAN BILL OF HEALTH.

When oysterman David Oglesby's grandfather plucked an oyster from Mill Creek, he never thought twice about disease. Bushel after bushel of plump, juicy shellfish looked fine to him and tasted even better to his customers.

The senior Oglesby wasn't alone. Before the 1920s, hardly anyone worried about oysters and disease. The savory shellfish slipped by regulations just as easily as they slid down diner's throats.

Epidemics of typhoid fever in New York, Chicago and Washington soon changed that.

The cause. . .sewage-polluted oysters.

The cure. . .national standards for testing shellfish waters and authority to close polluted ones.

By 1925, North Carolina had its own Shellfish Sanitation Program to oversee Mill Creek and other state oyster grounds.

But 64 years later, scientists still want the poop on shellfish and sewage.

Increased development and populations nationwide put pressures on shellfish growing areas. Now researchers must look for better ways to test polluted waters and improve purification methods.

Human and animal wastes are almost solely responsible for shellfish contamination, says Mark Sobsey, a Sea Grant researcher and a biologist at the University of North Carolina at Chapel Hill.

Bacteria and viruses flow into shellfish waters from seepage or septic tank overflow, sewage, discharges from industry, agricultural runoff or marinas with heavy boat traffic, he adds.

Oysters pick up harmful wastes as they feed on suspended particles in the water. Contaminants don't affect them. They don't even make the oysters look or taste different.

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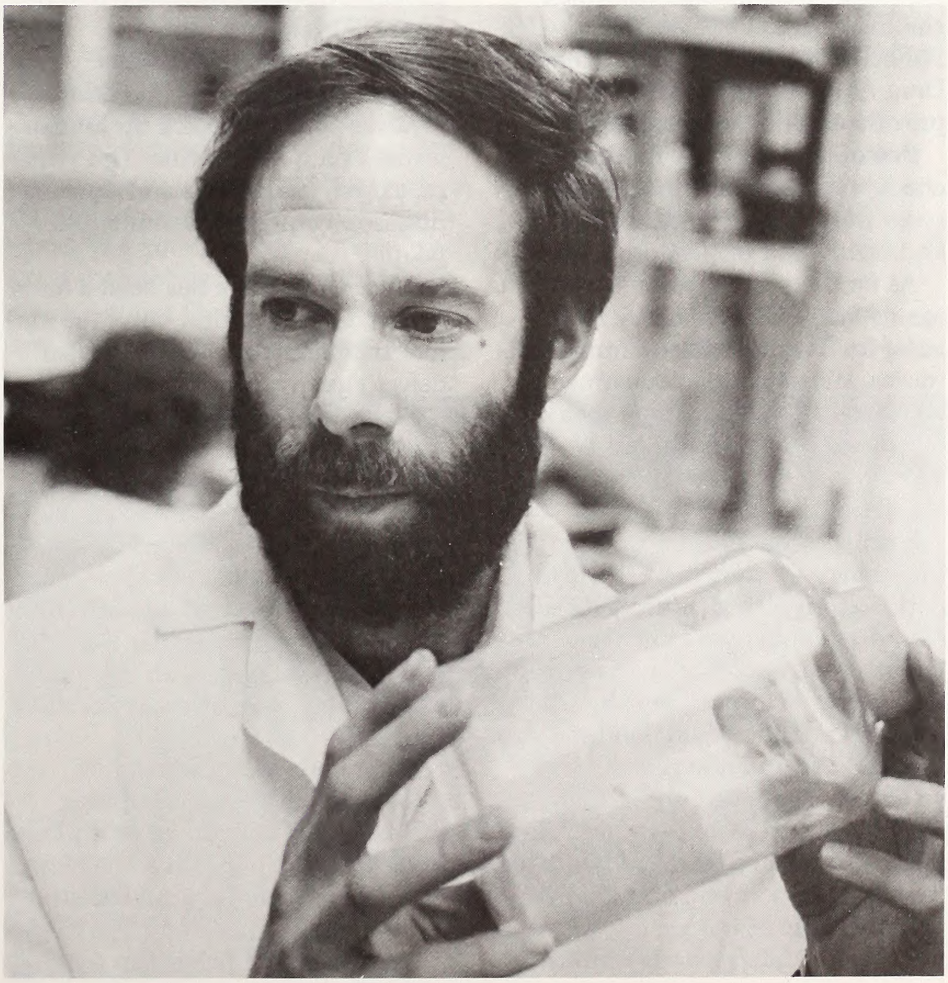


Biologist Mark Sobsey.

Photo by Neil Caudle

He has less bottomland to fish than his grandfather did, but oysterman David Oglesby is still on the water.

Photo by Nancy Davis

But if someone eats a tainted oyster that's raw or partially cooked, he may get sick.

Typhoid fever is rare these days, but other symptoms can occur.

If you've ever eaten an oyster that's sent you running to the bathroom, you know.

Nausea, vomiting and diarrhea can strike within hours of eating contaminated shellfish. Or in a few cases, stomach or intestinal illnesses can occur.

Bob Benton, head of the state's Shellfish Sanitation Program, says he gets reports of about four or five cases a year. Most of the outbreaks can be traced to oysters taken from illegally fished waters or from imports.

To guard against bootleg operations, the Division of Marine Fisheries polices North Carolina's shellfish areas. The state follows U.S. Public Health Service and Federal Drug Administration standards to provide additional protection.

Benton and his crew routinely check waters and shellfish meats, inspect wastewater treatment plants and certify and inspect processors.

As for the past 64 years, the agents' main job is to check the water for harmful bacteria from fecal wastes. Waters close to oystermen when test totals show more than 14 organisms per 100 milliliters of water.

Oglesby can verify that.

Resting in his skiff on a cold December morning, the fisherman points up river to an area that's been closed for more than four years.

That was some of his private shellfish beds they closed. Now he fishes mostly on public bottomland.

The FDA and Public Health Service established the current standards in the 1970s, Sobsey says. The original measures set up in the 1920s were 70 fecal coliform bacteria per 100 milliliters of water.

"These standards have been useful in protecting the public from typical bacterial diseases such as typhoid fever," Sobsey says.

But in the 1950s, scientists discovered that oysters and other bivalves could also pick up human viruses such as hepatitis. The viruses, as well as diarrhea and stomach diseases, could be transmitted to people.

Since then, there has been a lot of research trying to find out if the current standards for testing can also detect viruses, Sobsey says.

So far the answer is "no."

"We need to look for a better indicator of shellfish viruses," Sobsey says. "We still don't have convenient ways to detect all viruses."

With his research, the Sea Grant scientist hopes to find a new testing standard acceptable by the FDA.

Keeping bad oysters off the market is one way to stop diseases from spreading.

Nature provides another way.

Remarkably, oysters can purge themselves of contaminants if placed in clean water. Over time, the clean water flushes out harmful bacteria and viruses.

North Carolina fishermen sometimes transfer polluted oysters to clean estuarine waters, under supervision, then harvest the shellfish when the cleaning process is done.

Federal law requires relayed oysters to stay in clean water at least two weeks. But Sobsey found that it may take longer to rid oysters of viruses. In his tests, it took one month to purify relayed oysters of all bacteria and viruses.

Commercial cleaning, or depuration, shows similar results.

Sobsey's lab tests simulating depuration revealed most viruses moved out rapidly. But one virus—Hepatitis A—persisted. Now he recommends commercial depuration periods also be extended.

In spite of his job, Sobsey still eats raw oysters.

The chances of infection are extremely rare, he says. And, he points out, all bacteria and viruses can be transmitted by other routes besides shellfish. Swimming in contaminated water, eating foods prepared by someone without proper hygiene, and mixing sick children in day-care centers can produce the same results.

By Sarah Friday Peters

WORKING ON THE WATER.

The boat motor hums in a quiet monotone as oysterman Raymond Graham skims across Newport River in his handcrafted skiff.

The water ripples as he makes his way to a familiar oyster bed about a half-mile from his fishing shack on the shore.

It was a trip the Mill Creek fisherman had made almost every day of his life. The water is in his blood, you could say.

Five generations of Grahams have worked the Newport River waters. The first dollar Raymond ever made came from culling oysters for 5 cents a bushel.

At 58, Graham still makes his dollars from shellfish—fishing and distributing oysters and clams all over the country.

He is one of more than 8,000 commerical shellfishermen in North Carolina, and one of the reasons oysters end up on our plates.

This December day, Graham is dressed in a blue flannel shirt, jeans, black rubber boots and a navy blue baseball cap depicting a boat and bearing the words ''Becky L. Smith.'' A chaw of tobacco rests in his cheek.

His hands and his eyes show oystering is hard work. To an outsider, it's both science and art.

Like farmers, oystermen work hand-in-hand with an unpredictable Mother Nature. It takes skill and luck to turn a profit.

In North Carolina, oystermen pick, tong or dredge for ''coons'' and ''rocks.'' They call smaller oysters coons because the shell is shaped like a raccoon footprint. ''Rocks'' are bigger and thicker. Both can be found along the coast in bays, rivers, inlets and sounds.

''You take an oyster,'' says old-time oysterman David Oglesby of Mill Creek. ''He doesn't want a real salt water or a real fresh water. He wants a brackish water.''

Oysters survive best in water with low to moderate salinity. They spawn during warm weather, sending millions of larvae floating through the water. The young oysters, or spat, cement themselves permanently to one place to grow. Oyster shells work best for a setting, Graham says, but other shells, tires and cans work just as well.

If larvae land on mud or shifting sand, they quickly die, says David Taylor, central district manager for the Division of Marine Fisheries. For this reason, the state plants shells to aid natural oyster production.

Weather, fungi, sponges, barnacles and disease impede setting, too, Taylor says. Usually a low percentage of young oysters make it to the marketable size of 3 inches.

It takes about 18 months to two years to get a 3-inch oyster out of the Newport River, Graham says. Oysters grow fastest in the winter.

The traditional, and legal, harvesting season runs from Oct. 15 to April 1 for shellfishermen working public bottomland. Those with privately leased bottomland can fish year-round.

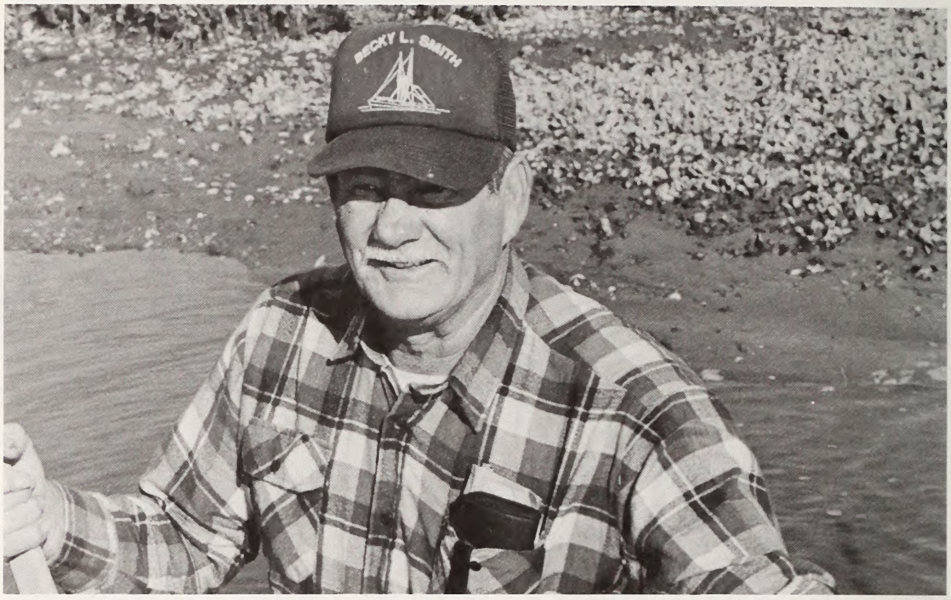
Graham has about 61 acres of

Continued on next page.

A Newport River oysterman pulls in the oysters while his wife culls them.

Photo by Nancy Davis

Photo by Nancy Davis



Shellfisherman Raymond Graham.

leased land on the bottom of Newport River. Once a year, he pays $5 to the state for each acre. Some of the leases came from his grandfather. Others he got from friends.

Riding along in his 18-foot skiff, Graham points out his plots. Each one is marked with corner stakes and signs with his name and lease number. Some 40,000 similar plots exist in North Carolina.

Out in Newport River, oystermen pick and tong for their spoils. Dredging, or harvesting with mechanical rakes from boats, isn't legal there.

''We've always caught them by hand,'' Graham says. ''It's the only reason this river's survived. . . .We've always had clams and oysters.''

To pick oysters, fishermen wait until low tide then wade on shoreline or sandbar-type shellfish beds. With a bucket and a pair of gloves, they pick out oysters to take back.

Around Mill Creek, though, most people tong, Graham says.

The boat slows as Graham reaches his destination in the middle of the river. Nine other fishermen, some with a partner or two, are already at work.

Graham grabs his hand-made tongs. He works the six-foot shafts in his hands like a giant pair of scissors and rakes the basket across the river floor.

In a minute or two, he pulls a basket full of oyster shells from the icy water and throws the live ones on a large culling board stretched across his boat.

A woman in a nearby boat sits by her culling board as her husband draws the oysters from the water. With a flat iron bar, she knocks pieces of shell from dead oysters off the good oysters.

Restaurants and oyster bars require oysters to be clean and single for serving on the half shell.

Cleaned oysters go in a bucket. Discarded shells fall back in the water as substrate for future oyster crops.

''If you throw them away with dead shells on them, you wouldn't be able to work,'' says the woman.

In minutes, Graham putters to another spot near an exposed rock covered with shells.

David Oglesby has been working the section since about 7 a.m. It's nearing noon now, and he has almost two bushels of oysters.

''That's about right for this time of year,'' he says.

Business could be better. But like Graham, the 70-some-year-old Oglesby fishes most every day.

He likes being on his own, making a living from the water.

Besides, he says, ''This is what I've done all my life.''

As the water shimmers and the wind breezes by on the ride back to shore, anyone could see why.

Oyster Culture Workshop.

Year-round markets for oysters have placed the savory shellfish in high demand. To meet that demand, and to aid in producing a surer crop, some fishermen cultivate their own oysters on leased bottomland.

North Carolina fishermen can learn more about oyster culture at an all-day conference at Duke Marine Lab on Feb. 25 from 8:30 a.m. to 6 p.m. Noted speakers from across the East Coast will give fishermen state-of-the-art findings and information to get them started.

The conference will cover hatchery and nursery techniques, stock selection and grow-out, diseases, predators, water quality, and financial and legal considerations for oyster culture.

Sponsors for the workshop include Sea Grant, the N.C. Division of Marine Fisheries, the N.C. Fisheries Association, the UNC Institute of Marine Sciences and Duke Marine Lab.

For more information, write Bob Hines at Sea Grant, P.O. Box 896, N.C. Aquarium/Pine Knoll Shores, Atlantic Beach, N.C. 28512. Or call him at 919/247-4007.

By Nancy Davis

SHUCKING AN OLD IMAGE.

Oysters are coming out of their shells.

No longer must they hide behind the misconceptions that have plagued them for years.

And for consumers, the news is good.

Used to be, the tasty bivalves were off-limits for folks on low-cholesterol diets.

But new research shows that oysters aren't the harmful foods they were once thought to be.

Joyce Taylor, Sea Grant's seafood education specialist, says that the old estimates of cholesterol in the shellfish were based on analyses that detected non-cholesterol components as well as cholesterol.

Recent findings show that mollusks, including oysters, are actually low in cholesterol. And they're even lower in cholesterol than some other seafoods.

A 3½-ounce serving of oysters contains about 45 to 55 milligrams of cholesterol, Taylor says. The amount of cholesterol in oysters may vary, depending on season, reproductive cycles and what the oysters are eating.

But be sure your cooking method doesn't elevate the amount of cholesterol in the dish, Taylor says. If you fry oysters in saturated oils, you're turning a healthy food into one you should avoid.

Taylor recommends cooking in unsaturated oils.

Or better yet, try roasting or steaming oysters in the shell. If you're using shucked oysters, bake or broil them or include them in a casserole.

Oysters are available in several forms. They are often sold live in the shell by the dozen or by the bushel. In grocery stores, you'll often find oysters shucked in half-pint, pint or gallon containers.

Oysters in the shell should be alive, Taylor says. The shells should be tightly closed or should close tightly when tapped.

Shucked oysters should be plump with a natural, creamy color and clear or slightly opalescent liquid. They should not contain more than 10 percent liquid, and should have a mild odor.

Taylor recommends you buy at least six oysters in the shell per person and one-sixth of a pint of shucked oysters per person.

If you harvest oysters for yourself, be sure you take them from open public waters, says Bob Benton, head of the state's Shellfish Sanitation Program.

If you buy live oysters from a dealer, be sure the bag or container is properly tagged, Benton says. The tag should contain the area and date of harvest as well as the dealer's name and certification number.

Shucked oysters should also contain the dealer's certification number and an expiration date on the container. Don't buy oysters with an expired date, Benton says.

And some folks prefer to shuck their own oysters, Taylor says. And for those people, Taylor has some advice. Be sure you're equipped with a good, sturdy knife and a pair of protective gloves.

And then choose from one of these methods.

1. With your knife, chip off the thin lip of the oyster until there is a small opening. Insert your knife and cut the muscles from the top and bottom shells. Then scoop the oyster free from the shell, and it's ready to serve on the half-shell or to use in other dishes.

2. Another method for shucking oysters is to work the knife into the front of the oyster opposite the hinge. Then go in deep and cut the muscles, twisting the knife and popping the oyster shell open.

3. Finally, you can insert your knife at the hinge and twist to pop the oyster open. Then insert the knife at the front and cut the muscle loose.

If you want more information on buying and handling fresh North Carolina seafood, write Sea Grant. The following brochures are available: *Hooked on Fresh Fish and Shellfish* (UNC-SG-85-08); *Bringing the Catch Home* (UNC-SG-86-26); *Dressing Finfish* (UNC-SG-86-10); *Flaking Fish* (UNC-SG-87-05); *Cracking into Crustaceans* (UNC-SG-88-01); and *Breaking into Bivalves* (UNC-SG-88-02). Each brochure is 50 cents.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

North Carolina's seafood processing industry stepped into the future in December when a plant in Plymouth, N.C., unveiled a state-of-the-art freezing facility.

The plant will serve as a model for the state's other seafood processors.

The demonstration project is part of an effort to improve in-state processing of seafood, says Sea Grant seafood extension specialist David Green.

Carolina's Pride Seafood and Liquid Air Corporation, an international company with its U.S. headquarters in California, worked with Green to develop the pilot facility.

At a ribbon-cutting ceremony to dedicate the facility, Gov. James G. Martin presented Sea Grant with a certificate of appreciation for its involvement in the project.

The seafood company will use cryogenics, a technology by which foods can be individually quick frozen at extremely low temperatures within minutes. The process has been used with other foods, but it's only recently been applied to seafoods.

The Plymouth demonstration facility is the first of its kind in the state's seafood industry.

Green says the project also will explore new packaging and marketing techniques for the frozen products.

The Plymouth facility is the showcase for a larger effort to improve the state's seafood processing industry.

Green says that ultimately the project will result in more seafood products being processed in North Carolina. And that will mean increased revenues for the state as well as new job opportunities.

"We want to present a quality image for seafood processing in North Carolina," Green says. "And the seafood industry is looking at improving its quality by upgrading its facilities and using new technology to be more competitive on a national and international basis."

UNC Sea Grant is soliciting proposals for the 1990-1991 funding period. If you're a researcher and would like to submit a proposal, call the Sea Grant office in Raleigh or consult the "Call for Proposals" memorandum available at the research office of your university.

All proposals must be submitted by April 14.

Sea Grant's Marine Advisory Service has formed an advisory board. The board is made up of 13 members with backgrounds and interests in everything from commercial and recreational fishing to local government and coastal regulations.

The board will help the Advisory Service remain responsive to its constituency.

The Advisory Service is Sea Grant's outreach or extension program. Its agents conduct educational and applied research programs in fisheries, seafood technology, aquaculture, recreation and tourism, marine education, coastal engineering, business development and coastal law.

The advisory board will recommend programs that will help the Advisory Service continually refine its priorities and develop new programs.

Members of the board and their backgrounds include: Bo Nowell, recreational fishing; David Owens, coastal management; Joseph Phillips, extension administration; Jerry Schill, commercial fishing; Clark Calloway, seafood processing; and Lockwood Phillips, news media.

Also on the board are: Webb Fuller and Tony Caudle, local government; Melvin Daniels Jr., banking; Carson Davis, recreation; Wende Allen, education; Steve Parrish, commercial fishing business; and William Raney, coastal law.

Recycling saves money, energy and natural resources. But for the most part, Americans don't take the time or make the effort to recycle their bottles, cans and newspapers.

Consider these facts supplied by the Environmental Defense Fund:

Americans throw away enough glass bottles and jars to fill New York's World Trade Center every two weeks. We throw away enough aluminum to rebuild our commercial airfleet every three months. And we use 2.5 million plastic bottles every hour, only a small percentage of which are now recycled.

In a brochure, *If You're Not Recycling, You're Throwing It All Away*, the EDF explains how recycling can save us money and how you can get started.

If you'd like a copy of the brochure, write the N.C. EDF, 128 E. Hargett St., Raleigh, N.C. 27601.

When manufacturers began touting the benefits of artificial seaweed to reduce beach erosion, Sea Grant coastal engineer Spencer Rogers was curious.

The idea was that the long strips of fiber acted as underwater sand fences that built sandbars.

But Rogers reviewed artificial seaweed research and monitored a test site containing the seaweed. And he found that the seaweed was not a viable solution for controlling beach erosion.

As a result, several North Carolina coastal municipalities saved thousands of dollars when they opted not to buy the seaweed.

In *Artificial Seaweed for Shoreline Erosion Control?*, Rogers examines this alternative. He addresses the development, experiments, problems and improvements of artificial seaweed in the past 25 years.

For your copy, write Sea Grant. Ask for UNC-SG-WP-86-4. The cost is $1.

When 99.9 percent of the bloater fish larvae died in Lake Michigan, most fisheries biologists studied the reasons why. But two North Carolina Sea Grant researchers and a scientist from the University of Wisconsin decided to take a different approach. They examined the .1 percent of larvae that lived to find clues to their survival.

For their research, zoologists James Rice and Larry Crowder of North Carolina State University, and Mark Holey of Wisconsin, received an award from the American Fisheries Society at the annual meeting Sept. 14 in Toronto. Plaques were given for publishing the "most significant paper" in the 1987 volume of the *Transactions of the American Fisheries Society*.

The team studied growth rings in the inner ear of this commercially important fish and found that the fish's size or growth rate influenced survival. They also identified a direct correlation between bloater populations and its main predator, the alewife.

"The concept they're working on is at the forefront of science," says UNC Sea Grant Director B.J. Copeland. Understanding the relationship between size and survival is crucial to fisheries management, he adds. Rice and Crowder have transferred their findings to a companion Sea Grant study in North Carolina using spot and flounder.

Coast to coast, recreational fishermen spend millions of dollars every year on saltwater fishing tournaments. And these tournaments are no longer small contests among friends. They have grown into large money-making businesses, with the same headaches of publicity, money management and legal decisions as any other commercial venture.

But for every tournament that succeeds, another falls by the wayside. Now, there's a book that explains the complicated process of organizing a tournament and gives tips for making them more successful.

Tackling Tournaments, published by Texas A&M Sea Grant College Program, provides an outline for organizing, financing, publicizing, managing and evaluating a saltwater fishing tournament. The guidebook provides helpful hints to directors who are old hands at staging tournaments, as well as to those who are just getting their feet wet.

UNC Sea Grant Marine Advisory Director Jim Murray and agent Jim Bahen provided a chapter on organizing tournaments for underutilized species.

For a copy of *Tackling Tournaments*, write Marine Information Service, Texas Sea Grant College Program, Texas A&M Univeristy, College Station, TX 77843-4115. Ask for publication number TAMU-SG-88-603. The cost is $15.

Sashimi isn't just for the Japanese. These thin slices of raw finfish are popular in the United States now, too. Sashimi is commonly served molded over rice and called sushi.

But even though it's increasing in popularity, some folks are concerned about the possible presence of parasites in the raw fish.

Doris Hicks, Delaware seafood technologist, reports that these live worms can only be transferred to people who eat raw or insufficiently cooked fish. And even then, the parasites are usually digested with no ill effects.

Hicks adds that fewer than 30 cases of illnesses resulting from the presence of parasites in sushi or sashimi were reported in the United States in 1986. And most of those cases were reported on the West Coast where more fish are infected with parasites.

Adequate freezing or cooking will eliminate possible infection from parasites, Hicks says. But in a home freezer, it can take up to five days to kill all the parasites, especially in large fish. The fish is also safe when it's been cooked and it has reached an internal temperature of 145 F for five minutes.

If you do eat raw seafood, Hicks recommends that you hold the fillet in front of a light so that any parasites can be seen and removed. The parasite is usually a tightly coiled, clear worm imbedded in the flesh. Simply cut off the affected portion.

For more information on parasites, write: Delaware Sea Grant College Program, University of Delaware, 263 E. Main St., Newark, Del. 19716. Ask for a two-page flyer, "Eating Raw Finfish: What Are the Risks, the Benefits?" Single copies are free.

Sea Grant Marine Advisory Service Director Jim Murray has received a grant from the National Marine Fisheries Service to survey artificial reef users.

Continued on next page

Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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To help us specialize our services, please answer these questions.

I am in the following line of work:

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__ City/County government
__ Commercial fishing
__ Educator
__ Farming
__ Homemaker
__ Lawyer

__ Marina operator
__ Marine recreation
__ Mass media
__ Seafood processing/marketing
__ State government
__ University professor/researcher
__ Other ____________________

Coastal property owner: __ yes __ no   Boat owner __ yes __ no

$________ contribution to defray printing costs for *Coastwatch*

Conflicts are rising over reef use and construction as more and more people are competing for a limited resource.

Murray will survey environmentalists, commercial fishermen, sport fishermen and divers in three Southeastern states to get their input on how they'd like to see artificial reef programs developed and managed.

Then he'll turn his results over to reef managers.

Offshore anglers are always looking for a spot that will guarantee them a catch of snapper, grouper or king mackerel.

Often recreational fishermen drop their hooks above the wrecks and artificial reefs where fish congregate. But these spots can be as crowded with anglers as a shopping mall on the day of a sale.

Why not try fishing the natural reefs offshore.

Sea Grant scientists have plotted the locations of these reefs in Onslow Bay—the area between Cape Fear and Cape Lookout—on a large, four-color map called the Hardbottoms Distribution Map. Hardbottom is a geologic term for reef.

The map charts low, medium and high-relief reefs. These irregular bottom areas support the small plants and animals that attract gamefish such as snapper, grouper, mackerel and sea bass.

For a copy of the Hardbottoms map, write Sea Grant. Ask for UNC-SG-86-25. The cost is $5.

The map includes a Loran grid and underwater depictions of the reef areas.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Vol. 16, No. 1, January, 1989. Dr. B.J. Copeland, director. Kathy Hart, editor. Nancy Davis and Sarah Friday Peters, staff writers.

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COASTWATCH

The Changing Guard

Photo by Gene Furr

Guard Duties

By Kathy Hart

If your vessel is on fire or your boat is taking on water, who do you call?

The United States Coast Guard.

The Coast Guard is well known for its aid to boats and ships in distress. In fact, Coast Guard crews save 16 lives, assist 361 people and salvage about $2.5 million in property on an average day.

But search and rescue is just one Coast Guard mission. The men and women of the Coast Guard do many jobs. They apprehend drug smugglers, replace buoys, clean up oil spills and inspect vessels for safety violations.

The Coast Guard is the primary federal agency entrusted with maritime law enforcement. But what started as a simple directive has mushroomed.

Today's Coast Guardsmen are trained in everything from first aid to fishery regulations to federal drug laws, says Lt. Martin Phillips, commander of the Cape Hatteras Group.

In North Carolina, the Coast Guard operates eight shore stations, one base at Fort Macon, one air station at Elizabeth City and a Marine Safety Office in Wilmington.

Four stations and 150 guardsmen fall under Phillips' command in Group Cape Hatteras. The stations are located at Coinjock, Hatteras, Oregon Inlet and Ocracoke.

Four stations, one base and 280 guardsmen work under the command of Lt. Cmdr. Dale Ward in Group Fort Macon. The stations dot the coast at Hobucken, Swansboro, Wrightsville Beach and Oak Island.

The Fort Macon and Cape Hatteras groups are part of the Coast Guard's 5th District that extends from New Jersey to North Carolina. The district headquarters is in Portsmouth, Va.

The Coast Guard is an armed force of the United States and is equal in status to the Army, Navy, Air Force and Marine Corps. In peacetime, the Coast Guard serves within the Department of Transportation. During a war or by presidential decree, it reports to the U.S. Navy.

In 1915, the Treasury Department formed the Coast Guard when it combined the Lifesaving Service and Revenue Cutter Service. In 1967, it was transferred from the Treasury Department to the Transportation Department.

Initially, the Coast Guard followed in the footsteps of its parental organizations and confined its duties to rescue and intercepting contraband. During Prohibition, which lasted from 1920 through 1933, guardsmen concentrated on apprehending rum runners, or liquor smugglers.

After Prohibition and World War II, the Coast Guard's primary responsibility shifted to aiding navigation and safety at sea.

During the 1970s, smuggling again reared its head. But this time, the illegal merchandise cached aboard vessels was multimillion-dollar shipments of marijuana and cocaine.

Nationwide, on an average day, the Coast Guard seizes 3,500 pounds of marijuana and 35 pounds of cocaine that total about $6.5 million. Also on an average day, guardsmen help other agencies confiscate another 243 pounds of marijuana and 26 pounds of cocaine worth $3.5 million.

They arrest two smugglers daily and seize a drug vessel every two days.

The effort expended by the Coast Guard to apprehend drug smugglers has increased four- to five-fold in the last 10 years, Ward says. And Ward and Phillips agree that with the increase in drug traffic has come an increase in danger for guardsmen. Drug smugglers are frequently armed.

Now boarding officers must be trained to know drug laws, proper boarding procedure, drug detection and recognition, and self-defense. Often Coast Guard officers are trained alongside U.S. Customs agents in detection methods.

"Every time we find a method smugglers are using to conceal drugs, they come up with a new way," Ward says.

Once a vessel carrying contraband is seized, it is turned over to U.S. Customs for processing by the U.S. Attorney General, Ward says.

Although North Carolina is no Florida, its secluded inlets, islands and bays are inviting transfer spots for smugglers.

"The North Carolina waterways are perfect," Ward says. "Smugglers can get in and out quickly. That's why pirates frequented the North Carolina coast."

Although drug enforcement may be the Coast Guard's toughest assignment, it's not its only one. During the 1970s and 1980s, Congress and the president expanded the Coast Guard's authority to include enforcement of environmental, fishery conservation, pollution, maritime defense and safety laws.

And last year, Congress increased the Coast Guard's duties again when it passed the Commercial Fishing Industry Vessel Safety Act of 1988. The act was passed to better safety equipment and procedures aboard commercial fishing boats.

When the act's regulations are finalized in 1991, they should save lives, standardize safety procedures, decrease insurance premiums and reduce liability suits.

But the law's passage means even more rules, regulations and laws for Coast Guard officers to know and understand. Even now when the Coast Guard stops a vessel, its boarding officers check for safety offenses, fishing infractions, contraband and environmental violations.

"You name it; we do it all on the water," says Master Chief Petty Officer Wayne Gray, a fourth-generation Coast Guardsman stationed at Oregon Inlet.

Gray, an Avon native, enlisted in the Coast Guard 31 years ago and has seen the Coast Guard swing its focus from search and rescue to law enforcement.

"Today we spend 60 percent of our time enforcing laws," Gray says.

Phillips says the Coast Guard's emphasis to the public on proper training, equipment and safety has reduced the need for search and rescue. Also the advent of sophisticated navigation systems and better weather information has helped more vessels avoid mishaps.

But that doesn't mean the Coast Guard doesn't answer distress calls. It does.

But if neither boaters nor their vessels are in danger, guardsmen refer them to towing companies or nearby boaters for aid.

"By not answering non-emergency calls, we save tax dollars," Ward says. "We don't have unlimited boats and personnel, so it is best not to tie up our search-and-rescue vessels unless there is an emergency.

"But let me emphasize," Ward adds, "if commercial assistance is not available or there's not a good Samaritan nearby, we will respond to a non-emergency call. We monitor every call for help to its completion no matter who comes to the boat's aid."

Fortunately, the Coast Guard gets a little help with its boating safety program from some friends. Nearly 40,000 men and women—all volunteers—serve in the Coast Guard Auxiliary.

These volunteers conduct free courtesy inspections of recreational boats, teach boating safety courses and assist in search-and-rescue operations.

But for many coastal residents, especially Outer Bankers, nothing but joining the Coast Guard itself will do. Many folks have family members who served in the Coast Guard or the old Lifesaving Service (see story, page 3).

"When I was growing up on the island (Hatteras), you either went to work on the water or joined the Coast Guard when you graduated from high school," Gray says. "Today there are more options."

But nonetheless, Gray's son is considering attending the Coast Guard Academy in New London, Conn., to become an officer. If he does, he'll be the fifth generation of his family to join.

"The Coast Guard has been great," Gray says. "I've served three tours in Florida and been to Vietnam. Now I'm back home again. Today's enlisted men are much better off. They have much better equipment and facilities."

But today's guardsmen aren't all men. Approximately 2,600 women serve in the Coast Guard. In fact, the Coast Guard was the first military service to admit women to its academy and the first to assign women as commanding officers of armed vessels.

All in all, more than 36,000 Coast Guard men and women stand ready—"Always ready" their motto says—to ensure our safety on the water, mark our channels, clean up our waterways, protect our natural resources and stop the invasion of drugs.

Photo by Gene Furr

Frying Pan light station keeps a lonely watch off Wrightsville Beach.

Heroes Of The Past

By Nancy Davis

Consider the days before fancy electronic equipment.

No radio signals to help sailors keep their bearings. No radar screens to show obstacles in their paths. And no weather reports to warn of impending bad storms.

Without all those gadgets, shipwrecks off the treacherous Tar Heel coast were commonplace.

But those early sailors in distress did have one thing pulling for them—a group of heroes called the U.S. Lifesaving Service.

From 1848 to 1915, the men of the Lifesaving Service, later to become the U.S. Coast Guard, risked their lives to save others.

And their record is impressive. From 1871 to 1915, the lifesavers tried to rescue 178,741 people. Of those, they saved 177,286.

Now, all that remains to remind us of their heroics are a few weather-beaten, shingled lifesaving stations.

But the heritage is rich, and the descendants of the lifesavers are not about to let their ancestors' stories die.

The Lifesaving Service's beginnings go back to 1848 when a New Jersey congressman introduced a bill to provide rescue equipment for shipwrecked sailors off that coast.

Soon the idea spread, and by 1871, Congress had officially established the U.S. Lifesaving Service as a branch of the Treasury Department.

From 1873 to 1874 only one shipwrecked sailor died in the area with lifesaving stations already established. That record of success led Congress to grant money for stations down through North Carolina.

Here, as many as 29 stations operated at one time. Most of those were clustered between the Virginia line and the tip of Cape Hatteras. They were generally spaced 7 or 8 miles apart.

A roster of Tar Heel lifesavers reads like a page from an Outer Banks phone book—Ballance, Daniels, Etheridge, Meekins, Midgett.

Sumner Midgett comes from one of those families that claims a long line of lifesavers. His father and his grandfather were in the Lifesaving Service.

And Midgett and his father were named after another famous Sumner—Sumner Kimball, the first director of the Lifesaving Service.

Midgett says that at one time, so many men from the Midgett family were lifesavers that folks started calling it the Midgett Navy.

Midgett spent his younger years moving with his father to stations at Ocracoke, Little Kinnakeet, Duck, Cape Fear and Fort Caswell.

"Shipwrecks were common then," he says. "We went for a month one time when they never missed a night getting a call."

On the East Coast, most of the lifesaving stations were of similar construction. Covered with cedar shingles, they were often two stories. The bottom floor was used for storing lifesaving equipment, including the boats.

The typical lifesaving vessels were government-contract built, says Mike Alford, curator of maritime research at the N.C. Maritime Museum.

They were usually 25 to 35 feet long. They were constructed in the lapstrake fashion. The planks were lapped over and fastened to each other, making for a lighter boat, Alford says.

For drills or rescues, the boats were rolled out of the stations on carts through large barn-like doors. Once they reached the surf, the lifesavers lifted the boats and launched them.

Flotation tanks in either end of the boat kept it from sinking if it were swamped with waves, Alford says.

From a tower on top of the station, a lifesaver stood watch over the water by day. At night or during storms or heavy fog, the lifesavers took turns patrolling the beach, Midgett says. They'd either walk or ride horses about 3 miles to the north, then 3 miles to the south.

To prove they had patrolled their section of the beach, the crewman would exchange tokens with the man of the station to the north and south at a keypost between the two.

If a ship were venturing too close to shore, the lifesavers would signal them with a flare.

When a ship was in distress, five or six men launched a surfboat and tried to row out through the crashing waves.

If the ship had grounded close enough to shore, the lifesavers would shoot a line out to the vessel with a lyle gun, a small version of a cannon.

Crew members on the ship secured the line around the mast.

Then a breeches buoy, or a life preserver fitted with a seat, could be sent from shore to the mast. Victims climbed into the buoy and were hauled, one by one, to safety.

The North Carolina coast has an especially rich lifesaving heritage. Some of the most famous rescues recorded occurred off the Outer Banks.

And North Carolina claims the distinction of having the only all-black lifesaving crew.

From 1880 to 1949 when it closed, the Pea Island Lifesaving Station was manned entirely by black personnel.

Agatha Gray, the widow of one of the lifesavers there, is gathering information about the old station. Her husband served there after the Lifesaving Service had become the Coast Guard.

"My husband loved his job," she says. "When we got married, he said, 'I love you dearly, but don't never keep me or hinder me from my job.' "

Gray is especially fond of passing along the story of the rescue of the *E.S. Newman*.

The *Newman* was enroute to Virginia in October 1896 when a hurricane arose. Station Keeper Richard Etheridge called off his patrol for the night because the storm was so violent.

But through the driving rain and vicious wind, a watchman in the lookout tower saw a light offshore.

Keeper Etheridge called his crew into action, and they fought their way to the beach.

But the weather was too rough to fire the lyle gun and the churning surf made it impossible to launch the surfboat.

So the lifesavers secured a rope on shore, then tied it to the two strongest men. Then Etheridge sent them swimming through the surf to the crippled vessel.

The lifesavers made 10 trips to the *Newman* until they had rescued every passenger.

"It's just a story that will make you cry," Gray says. "I can just see those men struggling."

Acts of bravery like that made lifesavers some of the most respected members of the community.

"They had a reputation for doing their job well for very little pay," Midgett says.

Midgett and Gray remember that the men of the Lifesaving Service had an unwritten motto. When a ship was in distress, the only guarantee was that the lifesavers would go into the sea and do everything they could to rescue the victims.

Midgett says his father used to say, "The regulations don't say you have to come back. You just have to go out."

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Visitors to the Outer Banks can take a step back in time at the Chicamacomico Lifesaving Station.

Jim Henry, president of the Chicamacomico Historical Association, says the station in Rodanthe is probably the most historic on the Eastern seaboard because so many heroic rescues took place there. And it's the only remaining station open to visitors.

In the summer, visitors can walk through the station, view artifacts in a small museum and, once a week, watch the beach apparatus drill performed by volunteers and National Park Service personnel.

The exterior of the station has been restored, Henry says. And now, the association is ready to refurbish the interior. But he estimates that it will cost at least $63,000. The association relies on donations and grants.

If you're interested in finding out more about the restoration, contact the Chicamacomico Historical Association, Box 5, Rodanthe, N.C. 27968.

If you want to visit Chicamacomico, call 919/987-2203 for a schedule.

Chicamacomico Lifesaving Station.

Photo by Michael Halminski

Safety On The Seas

By Kathy Hart

On the water, an ounce of prevention may be worth more than a pound of cure. It may be worth your life and that of your family and friends, say U.S. Coast Guard officers.

"Today the Coast Guard definitely puts more emphasis on accident prevention and boating safety," says Lt. Martin Phillips. "Any time we can prevent someone from having to be rescued, we're all better off. On the water, it's often hard to locate a boater in distress, and you don't always have a lot of time."

Most deaths among recreational boaters occur because life jackets are not worn.

"Often the jackets are accessible but not on," Phillips says. "Something happens quickly, and boaters are in the water before they know it. They end up drowning because they didn't have their life jacket on."

And, drinking and boating is just as much of a problem on the water as it is on the road. In fact, Phillips estimates that more than 50 percent of all fatal boating accidents involve alcohol.

"On the water, fatigue sets in quickly when you have a beating sun, whipping winds and wave after wave," Phillips says. "Reasoning fades quicker. Mix alcohol into that, and you have a serious problem with a person's ability to respond and react."

Stricter federal and state boating laws limit boating while intoxicated. To enforce those laws, Phillips' crews administer breathalyzer tests.

Recreational boaters are considered intoxicated if the test results are .10 or higher; commercial operators, .04 or higher.

But Phillips adds that drinking is usually not a problem among commercial fishermen.

A sound boating education can go a long way toward avoiding mishaps on the water, says Lt. Cmdr. Dale Ward.

"The boating public needs to be educated about the dangers of operating a boat and what can happen on the water," he says.

Ward suggests that all boaters enroll in a seamanship course taught by the Coast Guard Auxiliary or the U.S. Power Squadron. Auxiliary members will also conduct a free courtesy examination of your boat and safety equipment.

But Phillips and Ward agree that with more boaters using our coastal waters it may be time to consider a boating license. A license would ensure proper training and establish a minimum driving age.

Rough seas at Wrightsville Beach.

Photo by Gene Furr

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

Piece by piece, Beach Sweep '88 volunteers picked up 47 tons of trash and recorded it on data cards. Card by card, Sea Grant staff counted what the volunteers found Sept. 24 on North Carolina's beaches.

The totals revealed the types of trash washing up at the coast. And they provided some insight into where the debris may originate.

The data card divided trash into seven different categories. The largest of the seven, plastics, included such items as bags, bottles, diapers, fishing nets, six-pack holders and toys. Altogether, the plastics totaled 55,813 pieces.

The second largest category, paper items such as bags, cartons and newspaper, counted up to 23,616. Styrofoam pieces such as egg cartons, cups and fast food containers ranked third with 19,907.

Tallies of other categories included: metal — 19,480; glass — 9,928; wood — 5,620; rubber — 2,238; and cloth —1,311.

Beach Sweep coordinators sent the counts to Washington, D.C., for final tallies by the Center for Marine Conservation and the Environmental Protection Agency. They also became part of a national database that includes tallies from 24 other coastal cleanups.

As soon as the last bag of garbage was discarded at Beach Sweep '88, coordinators began planning Beach Sweep '89. The cleanup this year is scheduled for 9 a.m. to 1 p.m., Sept. 23.

Beach Sweep coordinators are looking now for companies that would like to donate supplies, food or funds for printing or educational materials. All donors will be recognized for their contributions. If your company would like to make a donation, call Sea Grant at 919/737-2454. Ask for Lundie Spence or one of the communicators.

The N.C. Division of Marine Fisheries has money available to help North Carolina shrimpers buy turtle excluder devices.

Beginning May 1, federal regulations require shrimpers with boats 25 feet or longer to use TEDs in offshore waters in North Carolina.

The devices are designed to exclude endangered sea turtles from nets.

Fishermen can be reimbursed, on a first-come, first-serve basis, for the purchase of federally certified models of TEDs.

For an application, write: TED Purchase Project, N.C. Division of Marine Fisheries, P.O. Box 769, Morehead City, N.C. 28557.

To get landlubbers involved in preserving North Carolina's coast, Raleigh's WRAL-TV is hosting a Carolina Coastal Celebration April 8 and 9 at the Kerr Scott Building on the N.C. State Fairgrounds in Raleigh.

The free event will showcase traditional entertainers, crafts, unusual seafood and educational exhibits about the coastal environment. Sea Grant and the Beach Sweep '89 sponsors will man booths at the two-day event.

WRAL-TV has made a commitment to addressing problems facing North Carolina's sounds and estuaries. The station produced a half-hour documentary, "Troubled Waters," and a series of informational public service announcements.

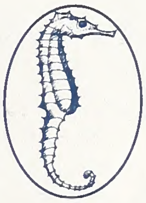
The station has also produced a booklet, *Sound Advice*. It is a resource guide that tells inland residents how they impact our coastal environment.

For a copy of *Sound Advice*, send $3 to WRAL-TV, P.O. Box 12000, Raleigh, N.C. 27605. Make checks payable to *Sound Advice*. Proceeds from the book will be donated to the N.C. Coastal Federation.

Walter Cronkite will drop anchor in Raleigh in March to talk about an issue near and dear to his heart—the coast and its waterways. The former CBS anchorman will join WRAL-TV and Sea Grant at a forum. It will be held March 11 at 7:30 p.m. at Stewart Theatre on the North Carolina State University campus.

Cronkite, a sailor and coastal enthusiast, will speak about the problems facing our estuaries and coastal rivers.

For more information about the forum, contact WRAL-TV at 919/821-8555.



Koalas and kangaroos, rolling hills and rain forests may not be that far away for 17 teachers. This summer, Lundie Spence, Sea Grant's marine education specialist, and two other science experts will lead a workshop to Australia on global environmental issues.

From July 6 to 25, the teachers will trek down under with Spence, Cathy Conwell of the University of North Carolina at Charlotte and Ray Ashton of the Massachusetts Audubon Society. They will investigate issues such as rising sea level and rain forest destruction first-hand.

Ten scholarships of $1,500 will be available for interested fourth- to twelfth-grade science teachers. Other criteria for eligibility are listed in an application form available from the Sea Grant office in Raleigh.

Funding for the workshop and scholarships is from the Title II, UNC Math/Science/Education Network. Each scholarship will cover about half the cost of the trip.

For more information or an application form, write Spence at Sea Grant.

Continued on next page

Winter is planting time at the coast. If you're a coastal property owner, now is the time to protect your investment with beachgrasses, shrubs and ground cover.

And Sea Grant has a publication that will help you. *Seacoast Plants of the Carolinas for Conservation and Beautification* is a general guide on the use of plants for landscaping and stabilizing sandy coastal soils. The 206-page paperback book contains illustrated descriptions of more than 100 plants that are native to the North Carolina coast.

For your copy, write Sea Grant. Ask for UNC-SG-73-06. The cost is $4.50.

Ten years ago, the dunes in front of the Fort Fisher State Recreation Area looked more like mole hills than mountains. So Sea Grant's coastal engineer Spencer Rogers developed a low-cost method to begin repair of the damaged dunes.

For nine years now, the Christmas Tree Recycling Project has thrived. Each year after New Year's Day, people bring their Christmas trees and place them on the dunes. After several days of high winds, the trees can trap one to two feet of sand. Vegetation spreads onto the new sand and permanent repair of the damaged dune takes place.

Although volunteers save a tree to save a dune, their efforts also help save the state thousands of dollars. By placing 8,000 trees in the dunes instead of expensive sand fencing, Rogers estimates the project saved $55,000.

The Christmas tree project, run in conjunction with the Fort Fisher State Recreation area and the N.C. Aquarium, has been so successful that it doesn't need to continue, Rogers says. The dunes have built back up to a safe, protective height.

Two North Carolina students have been chosen for National Sea Grant Program internships in Washington, D.C.

Josh Kardon, a law student at the University of North Carolina at Chapel Hill, will intern in the office of Barbara Boxer, a congresswoman from California.

John Baker, a student at the School of Natural Resources at Duke University, will intern with the U.S. House of Representatives Natural Resources Committee.

Kardon and Baker were among 10 legislative interns selected this year.

Sea Grant Director B.J. Copeland says the internships offer students a chance to extend their education beyond the classroom.

"It's a great experience for them to see how the system works, and it allows them to expand their education," Copeland says.

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COASTWATCH

Netmaking

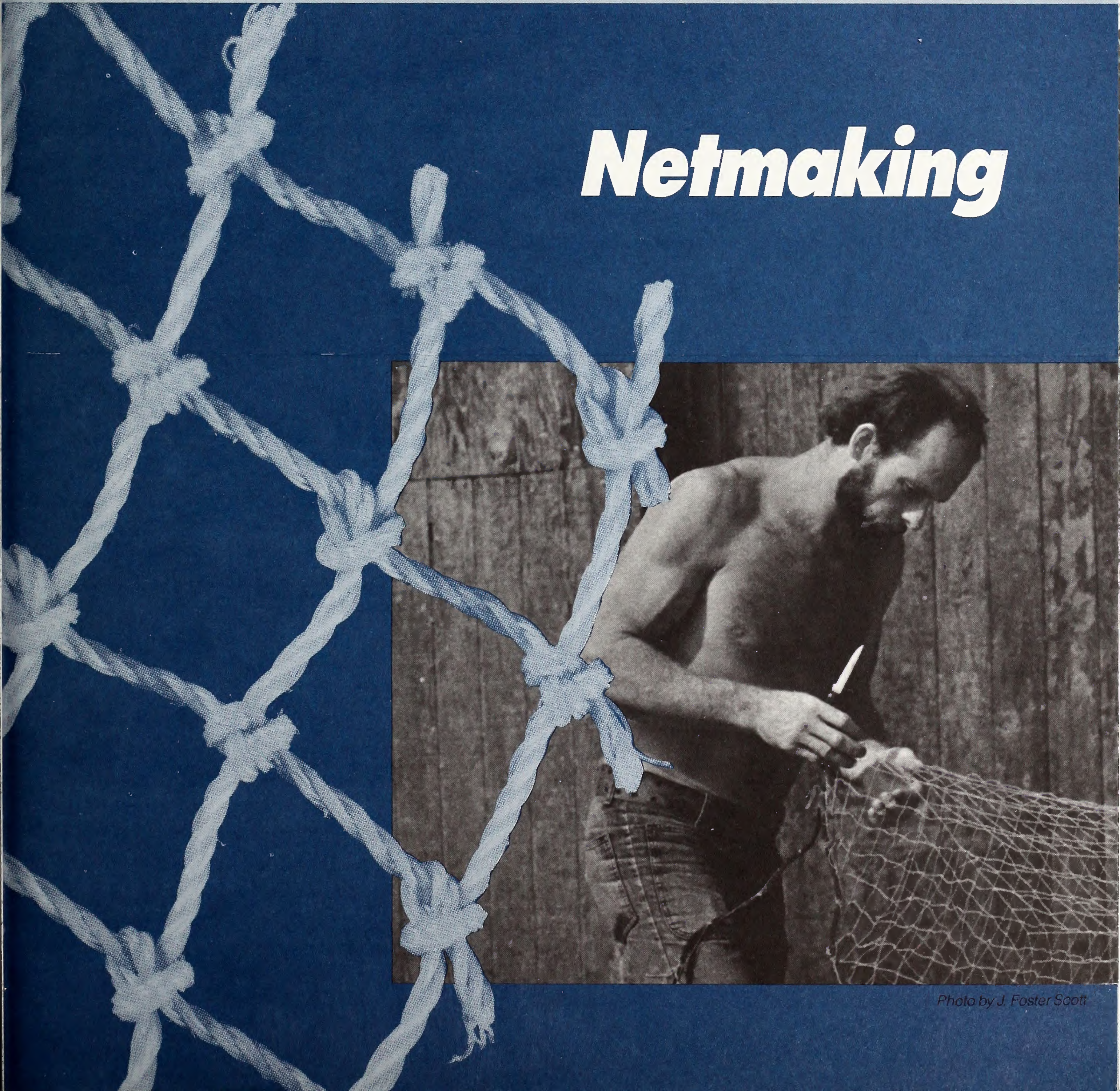

Photo by J. Foster Scott

A Stitch in Time

BY KATHY HART

Neal Harvey

Photos by Scott Taylor

Almost without thinking, Neal Harvey whips his needle in and out of the webbing. His nimble fingers tie knot after knot in a time-honored craft that is as synonymous with fishing in coastal North Carolina as the fish themselves.

Harvey is a netmaker.

He slipped into the profession. He used to fish and mend nets, his own and others, on the side. But he decided to combine his knowledge of how nets fished with how nets were made.

He and his son set up business and hung a sign proclaiming their profession outside an old building in Davis.

But Harvey joined a profession, what many consider a craft, that is on the wane.

Many older fishermen know how to construct, or hang, their own nets. And any good fisherman knows how to repair a net, says Sea Grant agent Jim Bahen.

But many of today's year-round fishermen are too busy to make their own. Instead, they turn to a skilled, professional netmaker to hang the most valuable piece of equipment on their boats.

In Brunswick County that means fishermen often turn to Steve and Sabrina Parrish, owners of a net shop in Varnamtown.

The Parrishes began making nets with the help of Sabrina's grandfather, Crawford Fulford, and Steve's uncle, who taught the couple about meshes, floats, chains and, most importantly, net designs. Steve designs and cuts the nets; Sabrina sews them and runs the business.

"I helped Granddaddy do the chafers and thread the needles when I was young," Sabrina says. "I guess you could say netmaking was in my blood."

Fulford hung nets for over 60 years. He kept notebooks scrawled with descriptions and drawings of each net he made.

"When Granddaddy stopped making nets, he asked his customers to use us," Sabrina says. "If we were making a net for one of the customers he recommended, he would come over here and count the meshes to make sure it was right before we sold it."

Sabrina says when her grandfather began hanging nets, the mesh and roping were made of cotton or other natural fibers. To make them sturdy and long-lasting, the nets were dipped in tar.

By then, machines wove the cotton webbing. But prior to mechanization, fibers were spun into twine and the twine was knotted into webbing. It was a long and tedious process, but one fishermen used for centuries.

Before motor power, Tar Heel fishermen used gill nets, pound nets, fyke nets and seines that were either staked in the water or dragged by hand.

Watermen in the Northeast had pulled the funnel-shaped trawls behind sail-powered boats. But trawls didn't gain wide acceptance until the advent of motor power at the turn of the century.

As transportation improved and refrigeration became prevalent, fishermen began targeting more species of fish. And to catch the different species, nets became more specialized. Netmakers varied the size, shape and webbing in their nets to catch different fish.

Even today, netmakers continue to modify their nets, says Harvey.

"Netmaking is an everlearning process," Harvey says. "The bigger boats that go up North bring back new net designs, and every four or five years shrimp nets are redesigned."

Harvey says netmakers learn about new net designs from publications such as *National Fisherman* or by word-of-mouth.

"You can bet if one fisherman sees another fisherman bringing in more boxes of fish he's going to find out what kind of net that fisherman is using," Harvey says.

And even the same type of net will vary from netmaker to netmaker. For example, the Parrishes' mongoose will be slightly different from Harvey's.

"Mine may be cut a little different," Harvey says. "Or I may add a little extra to the wing or the belly.

"Netmaking is like sewing. If you change the length of the sleeve, you change the look of a shirt," he says. "If you change a net by one or two meshes, you change the way everything fits together and how the net catches."

And nets aren't just tailored to differentiate between species of fish and shellfish. Shrimp nets can actually be cut and hung to distinguish between pink, white and brown shrimp.

"Brown and pink shrimp are caught more along the bottom," Steve says. "White shrimp are caught in the water column. We design the nets to take care of those differences."

Besides species information, netmakers must also know other basic facts before they design a net. They need to ask about the size of the boat, the horsepower of the engine, whether or not the boat is equipped with a winch, where a fisherman intends to fish and whether the fisherman is a full-timer or part-timer. Each factor affects the design, Steve says.

And nets vary from region to region in North Carolina not only because of species differences, but because of bottom conditions and water clarity. As a result, a net that catches well in Brunswick County waters may not catch well at Sneads Ferry, Beaufort or Hatteras.

With so much to consider, it takes a smart netmaker to build today's more sophisticated nets, Bahen says. Netmakers have to be willing to experiment with net designs and materials.

And like designs, net materials change. Almost everything used to make today's net is synthetic.

Webbing is made of nylon, polyethylene or polypropylene and imported from Taiwan, Hong Kong or Korea. Sabrina says she must order and pay for her webbing as much as a year in advance. And this can create problems if special needs arise.

For instance, last year a brown algae appeared in Southeastern coastal waters that clogged nylon shrimp nets. But the same trawls made of polypropylene didn't snag the algae. As fishermen learned about the change, demand for the polypropylene exceeded supply.

The Parrishes quickly sold out of the material with no hope of getting new supplies from the Far East.

The roping used for towlines, leadlines and floatlines is also synthetic and sometimes reinforced with steel. All corks or floats are Styrofoam or plastic.

All this synthetic material adds up to a more durable net that requires less maintenance.

Even the netmakers who hang gill nets or small shrimp nets in the backyards of Harkers Island and Hatteras use synthetic webbing. The netmakers who comprise this small cottage industry are usually women or retired part-time fishermen.

These folks hang small nets for relatives who fish or for larger net shops. And often they do repair work.

They stretch the webbing between two trees, stakes or sometimes the front porch posts to sew on leads or floats or mend holes. Netmakers hang these traditional nets just the way their fathers and grandfathers did.

And there will continue to be a need for this cottage industry and its craftsmen as long as fishermen continue to set gill nets or pound nets. But for larger, more sophisticated nets, commercial fishermen turn to full-time netmakers such as Harvey or the Parrishes.

When it comes time for a fisherman to choose a netmaker, it's what is not said that counts, netmakers say.

"Fishermen don't brag on you," Steve says, "because they don't want others to know their secrets."

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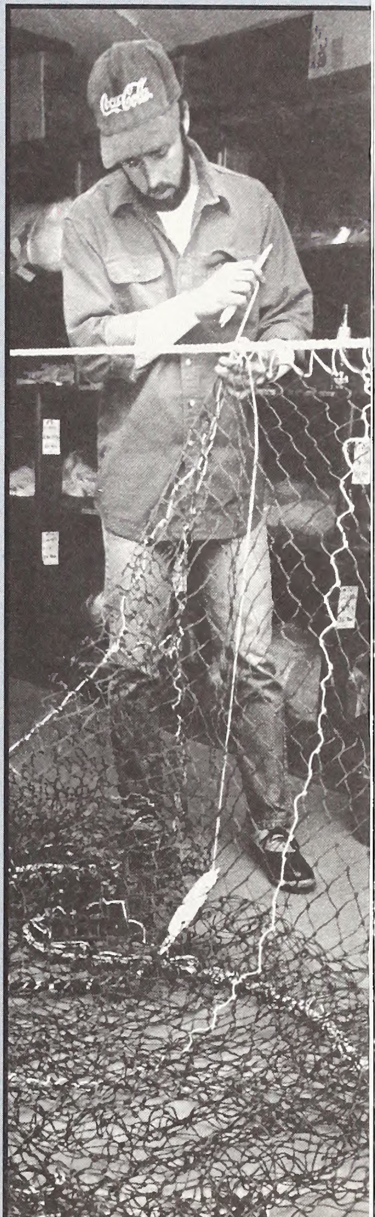


Dennis Harvey

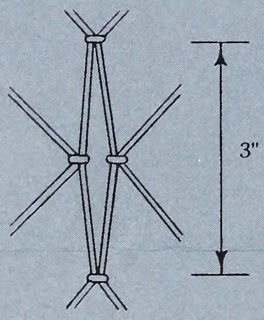
Netting Knowledge

BY KATHY HART

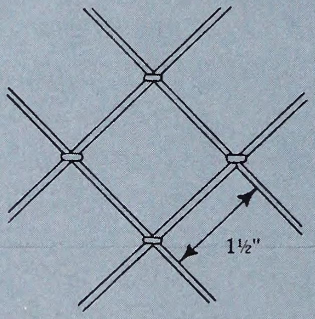
Like any craft, the art of netmaking has its own unique terminology. Here are a few of the words, phrases and types of nets that pepper a netmaker's language.

Mesh—Netmakers and fishermen often measure their nets in meshes (sometimes pronounced "marshes"). Meshes refer to the size of the diamond-shaped hole in the webbing. A net with large meshes will hold only big fish. To catch smaller fish, a smaller mesh is needed. The N.C. Division of Marine Fisheries sets mesh size limits for nets so that fishermen don't catch too many young fish or non-targeted species.

Fishermen speak of mesh sizes as bar mesh or stretched mesh. Bar mesh is measured along a strand from one knot to the next. Stretch mesh size is the distance between two opposite knots.



stretch mesh

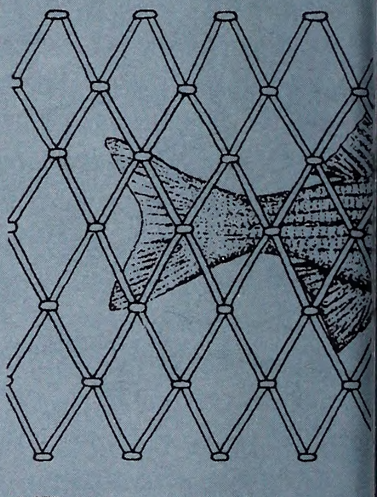


bar mesh

Doors—"Otter" doors, or trawl doors, are door-like structures that spread the mouth of the net and keep it open while the net is being towed. Doors are configured according to the species being caught and may be wooden or metal.

Floats—Along the top line of a net, corks made of plastic are attached at intervals to give a net buoyancy.

Leads—Along the bottom line of net, pieces of lead or chain are attached to weight the net down and spread it.



Gill nets—To catch striped bass, mullet, trout, croaker and flounder, fishermen often set gill nets in the state's shallow estuaries. These nets have openings large enough to allow a fish's head to pass, but not its body. When the fish tries to back out of the webbing, it is caught behind the gills.

A Stitch in Time

continued

In fact, some fishermen are almost superstitious about their netmaker.

"My son has a reputation for clam nets," Harvey says. "When fishermen bring their clam nets in, they tell me not to touch them. They only want him fooling with their nets."

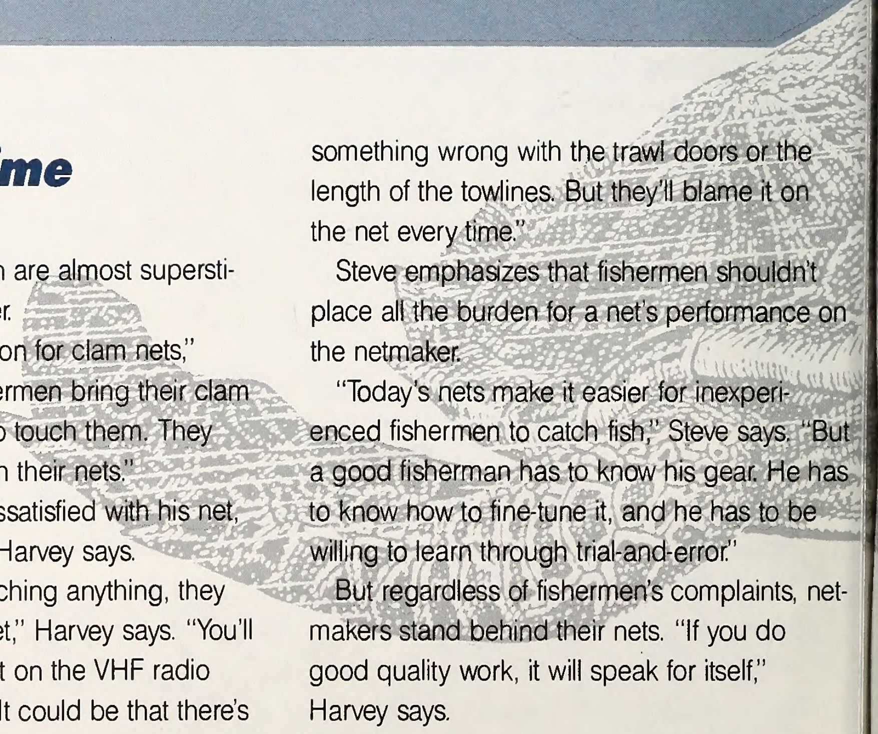
But if a fisherman is dissatisfied with his net, others will hear about it, Harvey says.

"If fishermen aren't catching anything, they always blame it on the net," Harvey says. "You'll hear them talking about it on the VHF radio while they're out fishing. It could be that there's something wrong with the trawl doors or the length of the towlines. But they'll blame it on the net every time."

Steve emphasizes that fishermen shouldn't place all the burden for a net's performance on the netmaker.

"Today's nets make it easier for inexperienced fishermen to catch fish," Steve says. "But a good fisherman has to know his gear. He has to know how to fine-tune it, and he has to be willing to learn through trial-and-error."

But regardless of fishermen's complaints, netmakers stand behind their nets. "If you do good quality work, it will speak for itself," Harvey says.



Gill nets, which are several feet deep and more than 20 feet long, can be anchored at various points (stake gill net), staked only at the ends (an anchor gill net or sink net) or allowed to float (floating gill net).

Pound nets—Pound nets are intricate nets that have a leader, heart and trap. The leader is a long expanse of webbing that extends to the shore. It bars fish from swimming downstream and directs them toward the heart. It is this heart-shaped funnel that channels fish into the trap. The trap is a webbed box with no top. It offers no means of escape for the shad, herring or flounder that swim into its midst.

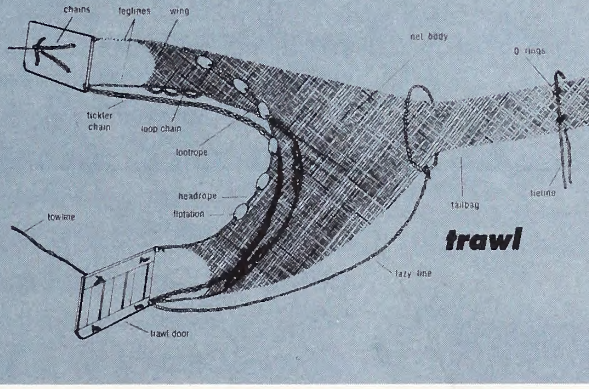
Fyke nets—Like pound nets, fyke nets are traps. They are set in channels where water flow is strong. A fyke net is a hooped net with wings and sometimes a leader to funnel fish to the entrance.

Seines—To encircle schools of finfish, fishermen use seines. A circle of netting is pulled tighter and tighter until the catch can be concentrated and scooped out. Seines have a small mesh that trap rather than gill fish. They can be set in a semi-circle against a beach or bank (a beach seine). Or, in deeper waters, two boats can be used to encircle a school of fish (long-haul seine). If the bottom of the seine is closed, or pursed, the net is a purse seine.

Seines are used to capture menhaden, river herring, flounder, spot, croaker, gray trout and striped bass.

Trawls—A trawl is a flattened, V-shaped net that is pulled behind a boat. Fish and shellfish are swept into the wide mouth of the net and accumulate in the tailbag.

Fishermen may tow from one to four trawls behind their vessels. Periodically, the trawl is winched aboard the boat to empty the catch. Trawls can be rigged to catch shrimp, crabs, scallops, flounder, spot, croaker and squid.



Designing a Better Excluder

BY KATHY HART

Varnamtown netmaker Steve Parrish called Sea Grant agent Jim Bahen with an idea.

He'd been giving this TED contraption some thought. Now TEDs, short for turtle excluder devices, had been designed by the National Marine Fisheries Service to let endangered sea turtles out of shrimp nets.

The 2½- by 4-foot PVC frame excluders worked. But the problem was fishermen didn't like them.

They were cumbersome and kind of expensive, grumbled fishermen. But most of all, they were worried that anything that put a hole in a net big enough to let out a 500-pound turtle would let out shrimp, too.

Parrish understood their concerns, and he had some ideas and designs of his own. He called Bahen, who had been putting the word out about TEDs at the local docks, to see what he thought.

Bahen added a few ideas of his own. Then, several sketches and a few yards of mesh later,

continued next page

A Better Excluder
continued

Parrish had a new TED—the Parrish soft TED.

"There were other soft TEDs out there," Parrish says. "But we were the first to make one that pushed the turtle out the bottom of the net."

The Parrish TED is made of 8-inch stretch webbing. It is sewn in the net between the main body and the tailbag. The webbing deflects turtles downward through a 40-inch hole in the bottom of the net. The opening is held rigid by a rectangular bar and closed with an elastic cord.

Pressure from a large object such as a turtle will cause the opening to gap and allow the turtle to escape.

But some folks had their doubts.

"People told us it couldn't be done," Bahen says. "They questioned whether a soft TED would really exclude turtles. And others said our version would let out too many shrimp."

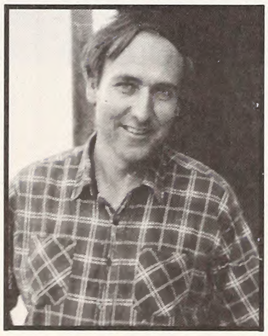
A test in North Carolina waters proved that nets equipped with the Parrish TED still caught plenty of shrimp. And a rigorous NMFS test in turtle-infested waters near Cape Canaveral proved the device excluded the large reptiles.

After the Canaveral test in October 1987, the Parrish TED seemed destined for federal certification.

But fishermen weren't always appreciative of Parrish's efforts. To some, it looked like Parrish was siding with the enemy.

"Fishermen think that we (netmakers) like TEDs because we can make more money off them," Parrish says. "I don't like TEDs any more or less than they do. I just wanted to design something that was easier and cheaper for the fishermen to use."

After the Florida test runs, Parrish waited for federal approval of his design and hoped it would receive a favorable nod before the May 1, 1988, deadline for mandatory TED use in North Carolina. But a maze of bureaucratic paperwork slowed the certification process.


Steve Parrish

Meanwhile, Louisiana fishermen, who were required to TED-up earlier than their Southeastern counterparts, took the issue to court in early 1988.

As the case was arbitrated, the mandatory use of TEDs was put on hold and so was the certification of the Parrish TED.

Finally, one year after it passed federal tests, the Parrish TED was approved. Its design specification and the regulations governing its use appeared in the Federal Register in October.

And after an appeals court ruled in favor of the federal government's right to require TEDs, the excluders are again slated for use this year.

But Bahen has his doubts. Rumblings among fishermen's groups in Louisiana and Texas have it that another suit will be filed.

As fishermen stall, Parrish and Bahen work to modify their design. Using a grant from NMFS, the pair will team up again in March to test various TED designs in a flume tank at the U.S. Navy Testing Facility in Bethesda, Md.

In preparation, Parrish has made a trawl net one-fourth the size of a usual net. In it, he will inset small TED replicas to test. A mock turtle also will be used to see how the TEDs expel the reptiles.

"In the flume tank, we'll see how the trawl and TED actually react under water," Parrish says. "We'll be looking at how different things affect the TEDs."

The data Parrish and Bahen gather will be fed into a computer model for final analysis and comparison. A scientist from the Massachusetts Institute of Technology will assist the duo with the computer analysis.

While Parrish looks toward future designs, he still must think about today's TED demands. Many Tar Heel shrimpers haven't bought a single excluder, hoping that litigation may prevent them from ever having to own one. But Bahen believes sooner or later both shrimpers and Parrish will have to TED-up.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

In the fall of 1987, clams were bringing record prices at the seafood dealer. And that got folks thinking about culturing the valuable mollusks.

So in February 1988, Sea Grant sponsored a workshop to teach fishermen how to handle young "seed" clams and how to rear the older clams in beds, or gardens.

More than 200 people attended the workshop. And so far, at least six prospective growers have purchased seed clams to begin culture operations. And many more folks are interested in setting up operations. Sea Grant marine agent Skip Kemp gets an average of 10 inquiries a week about raising clams.

Sea Grant Director B.J. Copeland estimates the new growers could contribute as much as $100,000 to the state's economy. And the N.C. General Assembly appropriated $90,000 to test the feasibility of double-cropping scallops with hard clams.

New Yorkers are dining on farm-raised hybrid striped bass from the Tar Heel state. The hybrid is a cross between a striped bass and a white bass. And for the past two years, Lee Brothers has been raising the fish on his Beaufort County farm.

Brothers is the first aquaculturist in North Carolina to produce a commercial crop of the fish and the first in the country to produce hybrids raised in ponds.

Brothers' harvest represents the success of a 10-year Sea Grant research effort that proved the commercial culture of the hybrid was feasible.

Ron Hodson, Sea Grant's associate director and coordinator of the program's aquaculture research, expects the hybrid to become a big cash crop for North Carolina.

Sea Grant's research on the hybrid began when wild populations of the savory striped bass dwindled. Scientists tried to raise the striper in captivity, but that proved difficult. Then they figured out how to cross the striper with a white bass. The result was a hardy hybrid.

At first, the hybrid was only stocked in recreational ponds and lakes. But Sea Grant researchers proved the hybrid could be farm-raised, like catfish.

Brothers put the hybrid to its toughest test. And in November, he began harvesting fish for market. They average 1½ pounds. So far, he has marketed his crop in New York where the fish are being served primarily in upscale restaurants.

Hodson believes that Brothers' operation is just what the state's fledgling aquaculture industry needs. A successful harvest will encourage others to try fish farming.

For more information on aquaculture, contact Hodson at Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

When it comes to the test of taste, the hybrid striped bass is getting rave reviews. Sea Grant seafood education specialist Joyce Taylor performed a series of taste tests with an informal consumer panel. She treated the panel to such delicacies as poached bass with caper sauce and barbecued bass.

And the hybrid scored well. In fact, the taste panel preferred the pond-raised fish over the wild striper in most of the recipes.

The panelists scored the hybrids higher on freshness, flavor and firm texture.

But those high scores could be attributed to the hybrid's freshness. The wild stripers had been on ice for several days before use.

The pond-raised hybrids also fared well in the lab. Sea Grant seafood extension specialist David Green and NCSU food scientist Leon Boyd evaluated the hybrid's composition.

They found that wild stripers were meatier than the hybrid, but the hybrids were leaner. And they found that the pond-raised hybrids were higher in the more desirable polyunsaturated fats.

For more information about the lab tests on the hybrid striped bass, call David Green at 919/726-7341.

Just a reminder: Proposals for Sea Grant's 1990-1991 funding period are due April 14. If you're a researcher and would like to submit a proposal, call the Sea Grant office in Raleigh.

Commercial and recreational fishermen seek out the Gulf Stream and its eddies because of the fish that travel its path. But finding this meandering corridor of water isn't always easy.

So Sea Grant agent Jim Bahen came up with a program that may make your fishing trips more fruitful.

The Gulf Stream Information Program provides fishermen with up-to-date readings on the Gulf Stream. Subscribers receive weekly charts that plot its width, average speed and path.

The charts are relayed from the National Weather Service's National Environmental Satellite Service each Wednesday morning. By noon, Bahen has shipped copies of the chart to his more than 200 subscribers, and they have the information in time for their weekend fishing trips.

To cover the cost of handling and

Continued on next page

postage, Sea Grant charges fishermen a nominal fee to subscribe to the program. For a six-month subscription from March to October, the cost is $8. A year's subscription is $15.

If you'd like to subscribe to the Gulf Stream Information Program, send a check payable to UNC Sea Grant to Jim Bahen, N.C. Aquarium/Fort Fisher, P.O. Box 130, Kure Beach, N.C. 28449. For more information on the program, call Bahen at 919/458-5498.

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Browsing the Sea Grant Bookshelves

It's springtime, and warmer weather signals the beginning of the tourist migration to the Carolina coast.

If you're one of those folks, shop around Sea Grant's bookshelves before you head to the shore. This month, we're featuring a few of our most popular publications of the season.

To order, write Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605. Make checks payable to UNC Sea Grant. Please indicate publication numbers.

Seashells Common to North Carolina is an illustrated guide to the state's shells. UNC-SG-72-09; 36 pages; $2.

A Guide to Soft Shell Crabbing instructs laymen on blue crab biology, identifying and handling peelers, harvesting and shedding methods, and more. UNC-SG-84-01; 32 pages; illustrated; $3.

How to Buy a Used Boat provides tips and a checklist for evaluating small recreational boats. UNC-SG-81-10; 16 pages; illustrated; $2.

A Guide to Ocean Dune Plants Common to North Carolina describes and illustrates the herbs, vines, grasses, shrubs and trees found on and near the North Carolina dunes. UNC-SG-87-01; 80 pages; $4.50.

Your Place at the Beach: A Buyer's Guide to Vacation Real Estate addresses the environmental hazards, ownership options and costs associated with coastal real estate. UNC-SG-87-04; 28 pages; illustrated; $2.50.

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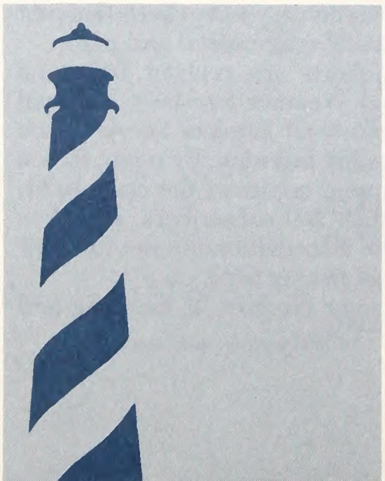

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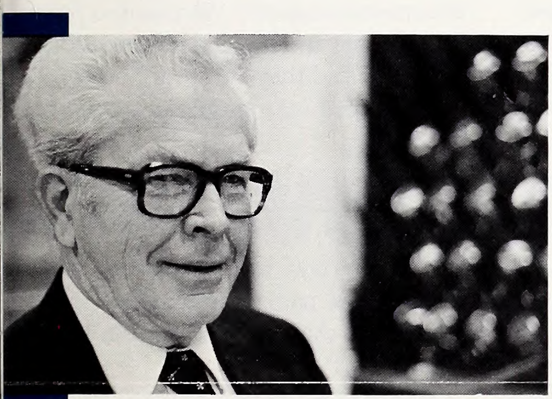
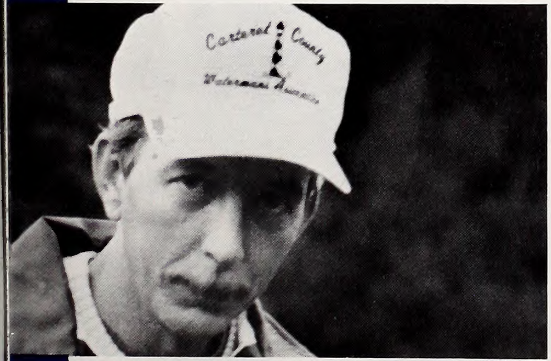


FRANK THOMAS

JOE & CELIA BONAVENTURA



CLINTON WILLIS

With the April issue, *Coastwatch* continues its yearly tradition of honoring people who have shaped the North Carolina coast.

Researcher and extension specialist Frank Thomas of North Carolina State University provided more than 30 years of service to North Carolina's seafood industry.

Joe and Celia Bonaventura, scientists at the Duke University Marine Laboratory, have made laboratory discoveries that earned them world acclaim and put new products on the shelves.

And Clinton Willis organizes and speaks out for the fishermen of Carteret County.

Frank Thomas

BY NANCY DAVIS

It's 1958, and Frank Thomas is traveling the back roads of Eastern North Carolina. He's driving a state car—one of those old black ones with an N.C. State College emblem stamped on the door.

The car alone makes him suspect. But he's from the state capital to boot.

Why, he could be a spy. Or worse. . . a revenue agent.

Thomas chuckles at that scenario now. But more than once in those early years, when he stopped to introduce himself, folks ran the other way.

They just weren't sure what to make of that young fella from that college up in Raleigh. Why, he was trying to give them advice on how they ought to operate their seafood plants. Imagine.

But that was more than 30 years ago. Now people in the state's seafood industry can't imagine what it would have been like without Frank Thomas.

They credit him with nothing less than pulling the state's seafood industry into the modern age.

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Frank Thomas
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"I think Frank's principal contribution to the seafood industry is bringing automation, quality control, the overall sophistication and general development to the state that it is today," says Alvah Ward, director of Business/Industry Development with the N.C. Department of Commerce.

"I can remember when quality control was zero. It was a wooden fish box with splinters and rusty shovels," says Ward, who has known Thomas for more than 20 years.

Now, North Carolina boasts some of the most technically advanced seafood processing plants in the country.

Thomas earned his doctorate at Pennsylvania State University in horticulture and completed a prestigious fellowship in seafood technology at the Massachusetts Institute of Technology.

In 1958 Thomas joined the faculty at North Carolina State University as a food processing specialist in the horticulture department.

Before long, he was answering phone calls about processing everything from baby foods to peaches to seafood. But he took a particular interest in the seafood questions.

When the university hired a specialist to handle fruits and vegetables, Thomas was free to concentrate on seafood.

"I realized that the seafood industry needed developing in North Carolina. It was much more disjointed than it is today. And it was really not even recognized as being a great player in the state's economy," Thomas says.

"There was no data available. Pasteurization was a new word. Demand for seafood wasn't there. All these things we know today were very primitive then."

But perhaps his greatest challenge was getting people in the seafood industry to listen to him.

Like a traveling salesman, Thomas took to the roads of coastal North Carolina, spreading the word about advances in seafood processing. Today he claims the distinction of knowing every shortcut in that territory.

"You didn't cut all the ice on your first trip," Thomas says. "It took two or three visits to establish trust. And a few months later, you see that he's adopting what you've been telling him.

"You constantly have to refocus your energy because the resource is always changing."

"When he found out I'd done him a service, eventually the word got out through the industry that I could help them out," Thomas says.

Sea Grant Director B.J. Copeland credits Thomas with establishing one of the country's first seafood extension services. His strong point was recognizing a need, then pulling together the expertise to attack the problem, Copeland says.

Tom Caroon, owner of Tom Thumb Seafood in Oriental and the president of the N.C. Fisheries Association, says the times Thomas helped are too numerous to mention.

Suffice it to say that Caroon knew who to call if his pasteurized crab had a gray color, if he had a bacterial problem or if his equipment wasn't functioning properly.

And if Thomas couldn't answer the question, he found someone who could, Caroon says. "I really looked to him as my troubleshooter."

Thomas was always one step ahead of his time. Early on, he was concerned about pollution problems the seafood industry might create. He convinced industry personnel that they could build their plants at water's edge if they designed them properly to handle the wastes.

A crab plant in Barco is testimonial to that. In 1968 Thomas and colleague Roy Carawan consulted with the plant's owners. "They wanted to run their liquid waste overboard," Thomas says. "So we said, 'Let us design your system.' We put in a huge septic system. They did as we recommended, and they've never had a waste or pollution problem to this day."

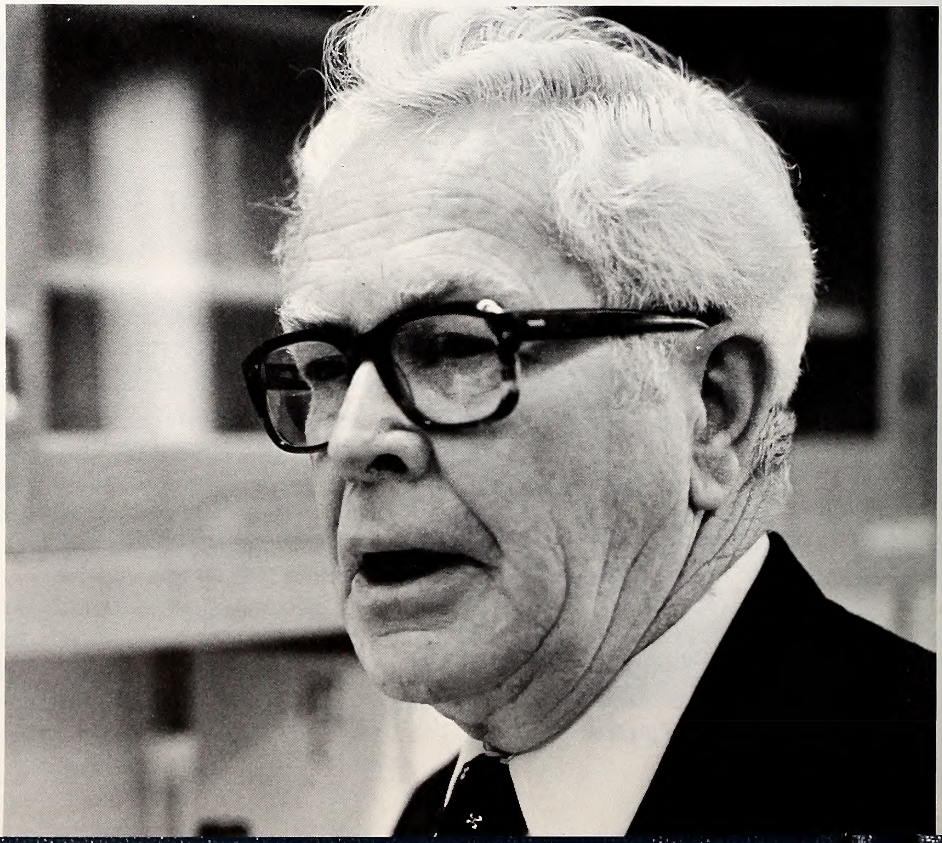
By encouraging innovations such as that, Thomas helped usher the seafood industry into the future.

In those days, much of the state's seafood was packed in ice and shipped to other states where it was processed.

By bringing the state's seafood processors up-to-date with new technology, Thomas opened the way for more seafood to be processed here.

"Through the work that Frank did

Photo by Nancy Davis



■ ***Frank Thomas***

with the plants here, it enabled our seafood industry to keep a lot of that value here," Copeland says. "That's been worth a lot of money to the state."

Copeland says Thomas also deserves much of the credit for the variety of species the state now markets. Twenty years ago, only 55 species were harvested.

Today, Tar Heel fishermen haul in 78 species of fish and shellfish, and they market their catch in all corners of the world. Thomas forged the way for fishermen to market such species as eel, squid and tuna.

"You constantly have to refocus your energy because the resource is always changing," Thomas says. "You're also working with long-term payoffs. You can't do these things overnight.

"Sometimes you plant the seeds for a new development or technology, and it's years before you see the result of your work."

Thomas' dedication to the seafood industry has earned him the respect of his colleagues at the university as well as his clientele at the coast. And his awards bear that out.

In 1984, he received the Earl P. McFee Award from the Atlantic Fisheries Technological Conference and an Outstanding Extension Service Award from NCSU. When Thomas retired in December, Gov. James Martin presented him with the Order of the Long-leaf Pine.

But perhaps his most coveted award was one he received from the people he served for three decades. In December, the N.C. Fisheries Association honored Thomas with a plaque of appreciation for his service to the industry.

Thomas' good relationship with the seafood industry has helped pave the way for his successors.

David Green, Sea Grant's seafood extension specialist, says, "The rapport he developed with the industry over the years has helped with our continuing programs today. It's helped me and others establish credibility with the industry."

Joe and Celia Bonaventura

BY SARAH FRIDAY PETERS

After 13 years, it's still there, crunched into a corner of Joseph Bonaventura's pocket.

To look at it, it's nothing special. Just a piece of sponge about the size of a big marshmallow and the color of moss in October.

But to talk with Bonaventura and his wife, you see the sponge is a dramatic symbol of the pair's accomplishments and a good luck charm for their future success.

Joseph and Celia Bonaventura, both 47, are world-renowned biochemists who specialize in respiratory proteins. At the Duke University Marine Laboratory on Pivers Island, they probe the mysteries of these biological agents that use and help carry oxygen in warm- and cold-blooded animals.

Over and over again they've looked at hemoglobin, the red-colored protein in our blood, and similar substances in fish to find ways to improve our health and environment. One of their first dreams was to create a device that could take oxygen from seawater and use it for underwater life-support systems.

The little green sponge was the first step.

In 1976, Joseph Bonaventura mixed his blood with a detergent and a water-loving plastic that looked and flowed like honey. As the mixture solidified, it formed a cherry-red sponge. When the sponge met water, Bonaventura's hemoglobin took in oxygen—just like a fish's gills. The oxygen could be released, too, with a small electrical charge or when washed in a special solution.

Over the years, the original "hemosponge" has turned green from oxidation, like an outdoor statue. But with its invention, the Bonaventuras realized their dream could become reality.

"When I made the sponge," Joseph says, "I realized that it was possible to take hemoglobin . . . and turn it into a plastic—an item that was manipulable."

They patented the hemosponge in 1980. Then Duke University sold it to a San Francisco-based company in 1983 for $1 million.

Using these and other funds, the Bonaventuras developed other products and applied for at least nine more patents by adapting the basic concept of the sponge.

The buyer, Aquanautics Corp., pursued perfection of the artificial gill that could take oxygen from seawater.

So far they've come close. In January 1988, researchers used the gill to produce enough oxygen per minute for two resting people.

And they found that the same basic technology behind the gill could be used for a variety of applications such as propelling underwater vehicles, supporting underwater stations, building portable respirators, and filtering oxygen out of beer and perfume before packaging to keep them fresh.

> **"They are very, very innovative in applying marine biology to biotechnology."**

One test for NASA found that the gill could be used to extract oxygen for use on Mars.

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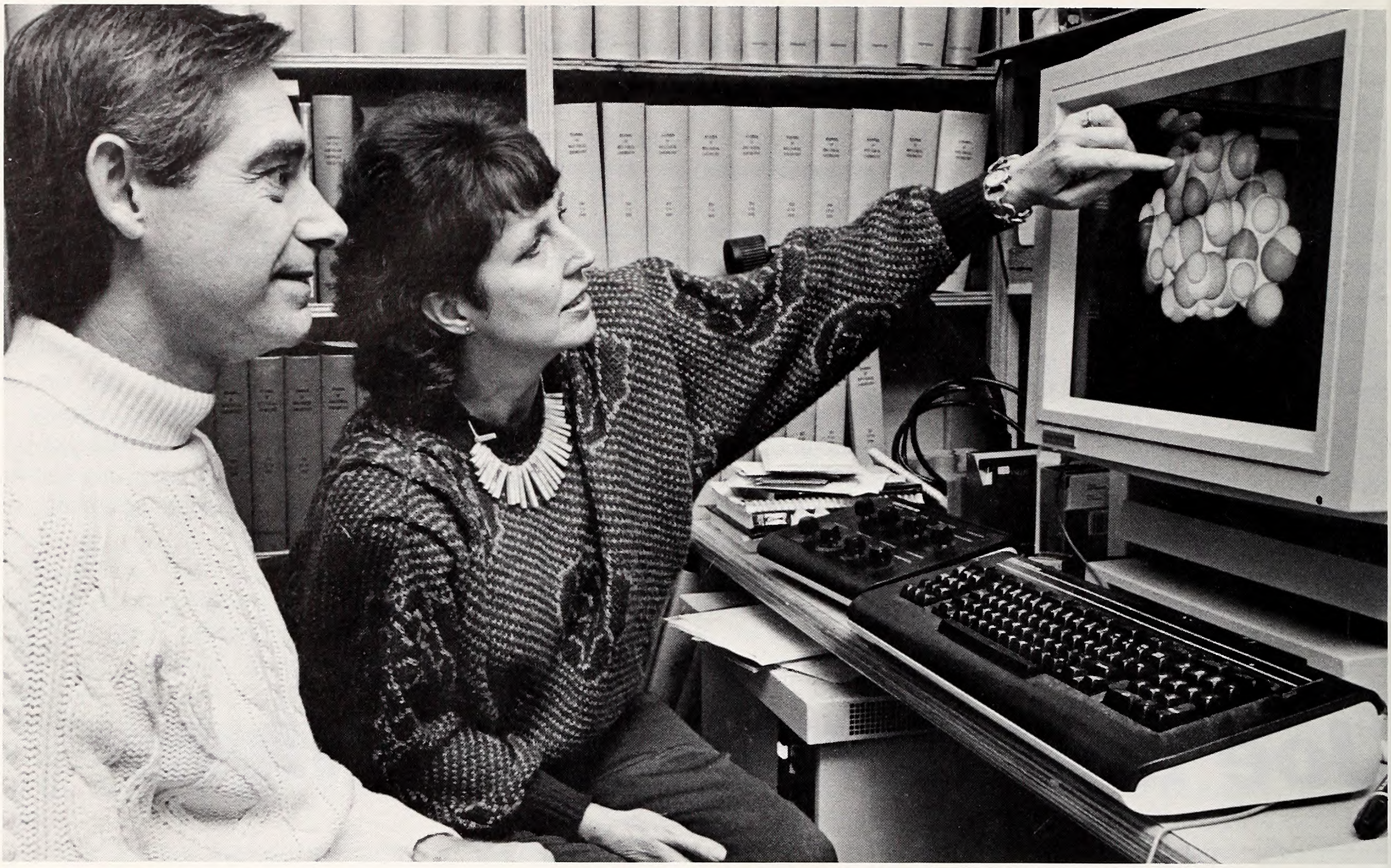

Photo by Scott Taylor

■ ***The Bonaventuras***

Joe and Celia Bonaventura

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"We're just beginning to see all the applications," Celia Bonaventura says. To her, this and the initial discovery that proteins could be "mobilized," or manipulated have been the highlights of her scientific career.

Besides meeting Joseph Bonaventura, of course.

It was spontaneous combustion in a San Diego, Calif., high school chemistry class.

She was a straight A student, and he was a class cut-up who left poems in her books. On their first date, they went to an electronics surplus store.

A few years later, in 1960, Celia and Joseph married as freshmen at San Diego State College. Then and there they made a pact to become scientific collaborators for life in biochemistry.

Their interests were so much alike they had to flip a coin before starting graduate school to see who would study what. Fate sent Celia studying photosynthesis and energy transfer and Joseph, hemoglobin and protein chemistry at the University of Texas at Austin.

In 1969, they completed their studies as postdoctoral fellows at the California Institute of Technology, then traveled to Germany and Italy.

Women in science were few at the time. At Cal Tech, Celia was one of only six women doing post-graduate work.

But, Celia says, "I found generally that my work spoke for itself. My work was at the forefront, so people were interested in what I was doing.

"I would say more challenging than being a female was being a female with a family," she says.

In 1965 and 1970, the Bonaventuras had little girls, Marina and Michelle.

"It's really hard not to combine fun and science when what we're doing is so exciting."

With family in tow, the couple finally began professional collaboration in Rome. Here, they realized they had differences in approach, but that they could work together.

"We do think differently," Celia says. "It's interesting to compare insights."

But both assume a serious responsibility for their work. "It's 60-60," Joseph says, "like a marriage."

"There's so much to do, there's no need or reason for a feeling of competitiveness between us," Celia says. "We've been very fortunate in that way."

Their work brought them to Duke Marine Lab in 1972. Now it carries them around the world. All together, they spend about three to four months a year traveling to Brazil, Saudi Arabia, Italy and the likes to give papers, collect samples and work with other scientists.

Three new projects in biomedicine, directorship of the Duke Marine Biomedical Center, foreign visitors, a partnership in a fish food business and continued research and applications fill the Bonaventuras' time.

They work about 16 hours a day, says fellow scientist Dan Rittschof. Until last year, they had never taken a vacation. But life is never dull around them.

"Things really are dynamic," he says. "You never know what's going to happen."

Words like "gregarious," "dedicated," and "brilliant" pepper his speech.

"They publish a lot and do all kinds of work," says Rittschof, an assistant professor of zoology. "The reason the B's are so well known is because when they say they're going to do something, they do it. You can look at their track record and tell."

Charles Hamner, director of the N.C. Biotechnology Center, has another theory on the couple's success.

"They're very, very innovative in applying marine biology to biotechnology," he says.

They take fundamental science and successfully apply it to products and technologies that benefit us all.

"The Bonaventuras are the most effective people I know who can successfully make that transition," says Joe Ramus, acting director of the Duke Marine Lab. "Almost all of their applied work has come from fundamental science."

Take the jelly fishing worms.

Mann's Bait Company wanted the Bonaventuras to create a lure that would make it easier for a bass fisherman to make a catch.

With a 15-second conversation in the hall, Rittschof became a collaborator. And soon the team came up with a plastic worm coated in a chemical that roused the fishes' taste buds and caused them to swallow.

"It's really hard not to combine fun and science when what we're doing is so exciting," Celia says.

"We've always had so much fun with what we're doing that we've never regarded it as work."

Clinton Willis

BY KATHY HART

It's a pretty day and fishermen around Clinton Willis' neck of waters, Marshallberg, are off by Harkers Island with their engines in full throttle and their nets spread.

But not Willis. He's sitting on a hard chair in a stuffy room in Greenville representing the commercial fishermen of Carteret County before the N.C. Marine Fisheries Commission.

Willis is president of the Carteret County Waterman's Association and has been since it formed four years ago.

It's a position he laughingly says he was elected to while out of the room. But it's one others say he won because he was fair-minded, even-tempered and hard working.

And work hard he has. He's spent hours collecting fishermen's views on everything from size limits on fish to turtle excluders. And he's been to countless meetings and hearings airing those views for public officials to hear.

"I used to be a fisherman," Willis says. "Now, I'm a politician, a lobbyist and a diplomat, too."

When proposed regulations have fishermen riled, Willis may spend almost all day and night on the phone. But even during lulls, he works a few hours of each day on association business.

"He's an unselfish man," says Jerry Schill, executive director of the N.C. Fisheries Association. "He's not paid. Only his expenses are reimbursed. Very few people would be willing to do what he does, and fishermen are better off because of it."

"Very few people would be willing to do what he does, and fishermen are better off because of it."

Bill Fulford, a Beaufort fisherman and a member of the Waterman's Association, says Carteret County fishermen appreciate Willis' time and devotion.

"He's put untold hours into it," Fulford says. "Not anybody else could have done any better. It's a full-time job. He eats, sleeps and breathes the association."

And, Fulford says, Willis is also respected as a fisherman. On the water, he's innovative and experimental—a highliner, says Sea Grant sociologist Jeff Johnson.

Many folks say Willis has performed a feat just short of a miracle by organizing and keeping fishermen, who are notoriously independent, assembled in an organization.

"The Waterman's Association is one of the most effective local groups in the state and a lot of that is due to Clint," Schill says. "A lot of times a local group organizes because of a particular issue. When that issue is lost or won, the group fades away. But not the Waterman's Association."

The association began four years ago with nine fishermen. The next meeting 12 fishermen came, and since then the group has been expanding. Now membership fluctuates between 125 and 300 fishermen.

The association divided the county into nine districts that represent areas such as Salter Path, Harkers Island, Cedar Island and Marshallberg. Each district has two representatives who sit on the executive board.

Willis feels that with formation of the association, fishermen established better lines of communication.

"Now we more or less know what's going on before it's too late," Willis says. "We learned that if you wait to read things in the newspaper, it's too late to fight them or support them. You've got to stay ahead of things."

So Willis uses a network of contacts to stay abreast of proposed regulations, rule changes and catch limits. By doing his homework and speaking

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Clinton Willis

continued

rationally about topics, Willis is a credible and respected spokesman, Schill says.

William Hogarth, director of the N.C. Division of Marine Fisheries, agrees.

"He's very reasonable," Hogarth says. "He meets and talks with us about issues. He considers all sides, and he doesn't rant and rave. He does a good job representing his fishermen."

Willis puts it like this: "I've always taken up for the little man. I don't know why, but there's a lot of satisfaction in it."

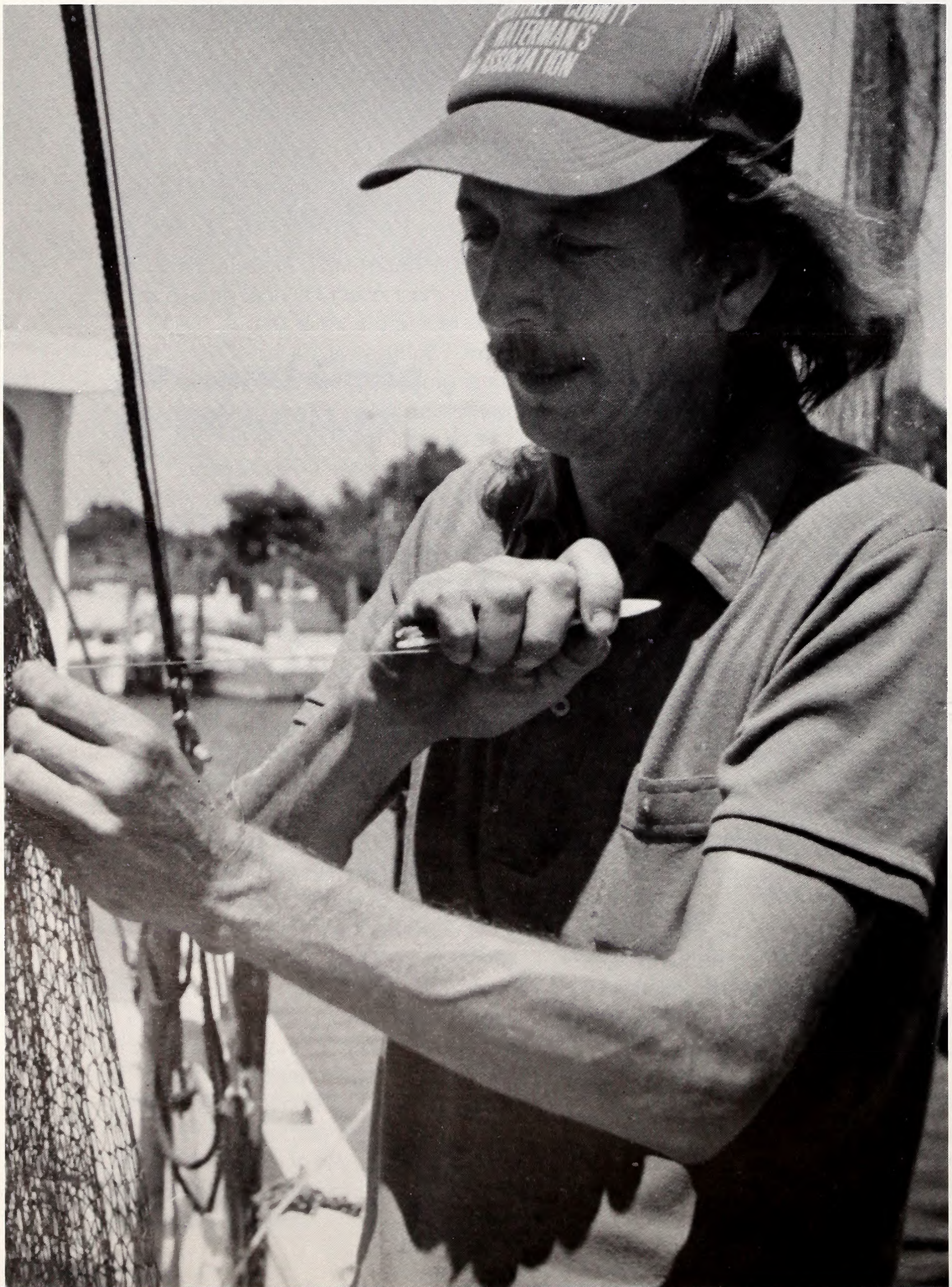
Willis works not only with state resource managers, but federal officials, too. And he doesn't hesitate to pick up the phone to call neighboring fishermen's organizations when issues cross state lines.

By working with groups in other states, he's gained a new respect for North Carolina's management system.

"For better or worse, hate it or not, the North Carolina Division of Marine Fisheries is the best and fastest way to manage the resource," Willis says.

"I don't know how you can manage resources through the legislature like they do in Texas and Louisiana," he says. "By the time you introduce a bill, squabble over it and lobby about it, then it is usually too late for the resource."

Photo by Jim Strickland



■ **Clinton Willis**

And, Willis emphasizes, fishermen are concerned about conserving resources.

"There's a misconception people have about fishermen," he says. "They think we want to catch it all. But they're wrong. We know there should be limits."

Resource management is just one issue Willis sees fishermen facing in the future. He's also concerned about water quality, imports, new licensing regulations and competition between recreational and commercial fishermen.

With such weighty issues to consider, sometimes Willis becomes discouraged.

"We're seeing a way of life dying," he says. "If I had a boy young'un, I wouldn't want him to go into fishing."

But Willis and the Waterman's Association hope to put some promise into the future by establishing a trust to help the public schools with their marine vocation and marine science programs. And they're exploring the possibility of establishing a scholarship in marine science.

The association also helps fishermen in other ways. They provide assistance during hard times, such as last year's red tide or when a waterman is injured or ill.

"We're a fisherman's organization that helps fishermen," Willis says.

To raise money for projects and daily operations, the association charges modest dues. And they sponsor the N.C. Commercial Fishing Show, held every March in Morehead City.

After four years, the Waterman's Association has made a name for itself in North Carolina. And so has Clinton Willis.

Some folks come to Willis for his opinion; others seek him out to hear theirs. Whatever, Willis sorts through the issues and represents his fishermen the best he can.

"I get blamed for a lot of things I didn't do, and I don't always get credit for the things I do do," he says. "But I guess that goes along with the job."

The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

After 10 years, *Coastwatch* has changed its look. With this issue, we've updated the masthead and "The Back Page." It will take us and you a while to get used to the new look, but we hope it is something you'll like.

Thanks to the *Coastwatch* subscribers who responded to our survey. More than 550 readers were randomly selected to answer some questions we had about our monthly publication. Of those questioned, 224 responded.

Our survey said that 74 percent of our readers have subscribed to *Coastwatch* three or more years; 20 percent, 1 to 3 years; and 6 percent, less than one year.

Each copy of the newsletter is read by 2.8 people. This means that more than 60,000 people read *Coastwatch* monthly.

Readers learned about our newsletter in various ways: 30 percent at the N.C. Aquariums, 26 percent from a friend, 15 percent from the newspaper, 5 percent at the library, 9 percent from the Sea Grant publications catalog and 24 percent from other sources.

On a scale of 1 to 5, with 1 being best, readers gave *Coastwatch* the following ratings: 1.58 attractiveness, 1.18 timeliness, 1.27 informativeness, 1.2 ease in reading, and 1.14 helpfulness.

When asked what readers liked most about *Coastwatch*, people said they thought it was informative, easy to read, factual, balanced and diverse.

When asked if readers had any suggestions for improving our newsletter, people said they would like to see it lengthened and published more frequently.

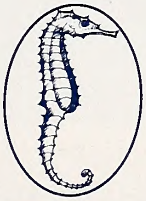
Readers wrote that they were most concerned about development, water quality, pollution and erosion problems along the North Carolina coast and would like to see us focus on these topics in *Coastwatch*.

The survey indicated that 62 percent of our readers had ordered a publication from "The Back Page." And, based on announcements in "The Back Page," 26 percent of the respondents said they had participated in a Sea Grant activity—Beach Sweep, a workshop or a conference.

More than 70 percent of the respondents said they were not aware that Sea Grant and *Coastwatch* had been threatened because of federal budget cuts. And of those readers who responded, 26 percent said they had made a contribution to Sea Grant to help support *Coastwatch*, and 86 percent indicated they would pay $5 a year to subscribe to *Coastwatch*.

The survey clearly provided food for thought. We'll certainly take on some of the topics suggested, and we're very happy that so many of you like our format, style and approach.

We, too, would like to expand and publish *Coastwatch* more frequently, but for now, budget and staff constraints limit us to eight pages an issue and 10 issues a year. However, if donations increase or a subscription fee is implemented, we will reconsider these suggestions.



The *Coastwatch* survey indicated many readers wanted to know more about other UNC Sea Grant newsletters. Five free newsletters are available. They're compiled by members of the Marine Advisory Service staff.

If you'd like to be on the mailing list, write Sea Grant and tell us which of the following newsletters you want to receive.

Conchshell, published quarterly, provides new ideas about marine education and an update of events. Editor: Lundie Spence, marine education specialist.

Legal Tides is for lawyers, planners and government officials. It addresses timely legal issues related to coastal and environmental law. Published quarterly. Editor: Walter Clark, coastal law specialist.

Marine Advisory News covers topics relating to commercial fishing and seafood in North Carolina. This bimonthly newsletter provides information on research, gear, fishing techniques and upcoming events. Editor: Bob Hines, marine advisory agent.

Seafood Current, published quarterly, updates seafood processors, retailers and restaurateurs about news from the seafood industry. Editors: David Green, seafood specialist; Skip Kemp, seafood marketing specialist.

Marina Messages is a quarterly newsletter for marina operators, marine equipment manufacturers and boaters that provides information on marina regulations and boating trends. Editor: Rich Novak, marine recreation and business specialist.

Ask any Beach Sweep volunteer from last year's cleanup and chances are they'll be back this Sept. 23 for Beach Sweep '89. It's a good opportunity to join others who care about the coast in cleaning up the beach. And it's a fun and educational event for groups of all kinds.

Scout troups, garden clubs, environmental organizations and science classes were just a few of the groups that joined in the cleanup last year. Sign up your club or organization now for Beach Sweep '89. Or volunteer for Inland Sweep, a cleanup on the same day that will cover the inland shorelines of lakes, rivers and streams.

For more information on Beach Sweep, call Sea Grant. Or call Jane Krupnick at the N.C. Wildlife Resources Commission in Raleigh to sign up for Inland Sweep. Her number is 919/733-7123.

Kudos go to three Sea Grant staff members.

Jim Murray, Sea Grant's Marine Advisory Service director, was elected chairman of the Southeast Sea Grant Marine Advisory Service Network. He will coordinate regional marine extension projects and organize a regional meeting.

continued on next page

Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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To help us specialize our services, please answer these questions.

I am in the following line of work:

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☐ Mass media
☐ Seafood processing/marketing
☐ State government
☐ University professor/researcher
☐ Other____________________
____

Coastal property owner: ☐ yes ☐ no Boat owner ☐ yes ☐ no

$__________ contribution to defray printing costs for *Coastwatch*

Rich Novak, Sea Grant's marine recreation and business specialist, was elected president of the Albemarle Area Development Association, an organization of business and community leaders from 10 counties in the Albemarle area.

And David Green, Sea Grant's seafood extension specialist, received his Ph.D. in food science from North Carolina State University.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Vol. 16, No. 4, April 1989. Dr. B.J. Copeland, director. Kathy Hart, editor. Nancy Davis and Sarah Friday Peters, staff writers.

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hoto by Scott Taylor

DUNES

The Making Of A Dune

By Nancy Davis

For some folks, dunes are little more than piles of sand they cross to reach the beach.

Sunbathers trample them. Surf fishermen plow through them in four-wheel drives. And some property owners don't appreciate the services they provide.

Sometimes it seems only artists and photographers take notice of them.

But sand dunes are much more than pretty backdrops for paintings and pictures. They provide a front line of defense against the power of ocean winds and waves.

"Dunes are an integral part of a barrier island's ability to maintain itself," says Sea Grant researcher John Wells.

"The most important thing about a dune is that it's a natural buffer to storm waves and an essential component in the sand-sharing system," says Wells, a coastal marine biologist at the University of North Carolina Institute of Marine Sciences.

But in their role of island protector, dunes take a terrible beating. Winds and waves pound them. And occasionally, storms sweep them away.

But even though one dune disappears, eventually another mound of sand will take its place.

The continual waxing and waning of a sand dune is part of a natural process, Wells says.

He describes a dune as a reservoir of sand. During storms, waves may carry part of the sand in the reservoir a short distance offshore. There, the sand may form sand bars that lessen wave action.

Eventually, the sea's natural wave action will deposit some of that sand back on the beach where it will be available as building material for another dune.

If you've ever felt the twinge of fine grains of sand blasting your ankles as you walk along the beach, you've witnessed a dune under construction, says Sea Grant coastal engineer Spencer Rogers.

"All it takes to build a sand dune is windblown sand and something to trap it," Rogers says. "And all it takes to get it to fall out of the breeze is something near the surface to slow the wind velocity."

The sun and winds blowing off the ocean dry tiny grains of sand on the beach. The lighter, finer grains become airborne.

The sand is whisked across the beach, and wherever there's an obstacle—a piece of driftwood, a sand fence or beach grass—the wind drops its load of sand.

Eventually, the wind will deposit enough sand to form a new dune.

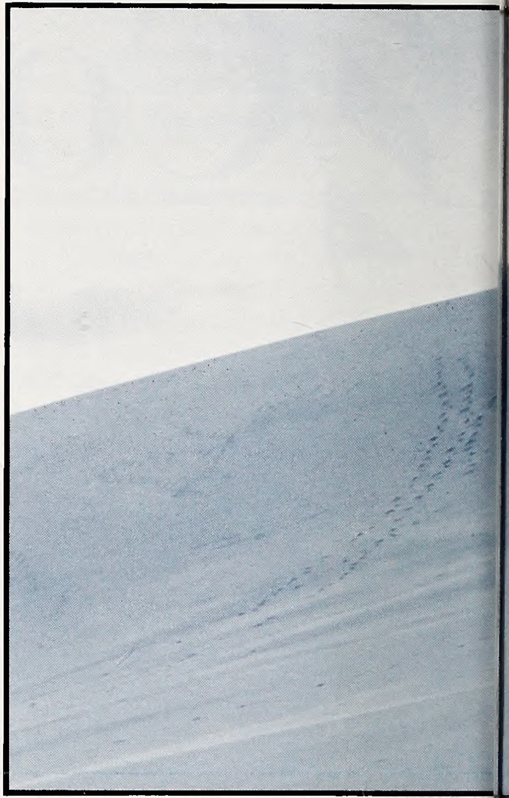
How long that takes is up to the availability of sand and the speed and direction of the wind, Wells says.

The wind also controls the shape of the dunes and whether there's a single ridge or a series of dunes, Wells says.

By examining the dunes on a beach, you can tell a lot about an island, Wells says. In North Carolina, islands that are oriented in an east/west direction tend to be more stable and have better developed dunes than islands oriented north/south.

As an example, Wells points to the differences in the dunes on Shackleford Island, an east/west oriented island, and Core Banks, with a north/south orientation.

The dunes on Core Banks are small and poorly developed. But Shackleford's dunes are high and stable.



On the Outer Banks, you can see evidence of another kind of dune ridge. But this is the work of man.

Before the 1930s, the dunes from Currituck to Ocracoke probably were much smaller, and during storms the ocean frequently surged landward. But the Civilian Conservation Corps stabilized the dunes in a continuous mound of sand.

At Jockey's Ridge, you can see an example of yet another kind of sand dune. It's the East Coast's highest dune, but it's not even on the beach.

Jockey's Ridge was formed from excess sand that has blown and washed over the beach dunes. With little vegetation on it, the dune continues to move.

A dune similar to Jockey's Ridge is the site of the Wright Brothers Memorial. But that dune has been stabilized with grasses, Rogers says.

Photo by Clay Nolen

Mounting A Sandy Defense

By Kathy Hart

Thirty years ago, most North Carolinians thought the dunes were. . .well, pretty. They provided some relief to an otherwise flat terrain, and the dune grasses and sea oats that topped their crests waved majestically in the sea breeze.

Developers of hotels and motels saw the dunes as an unnecessary barrier between their patrons and the ocean they came to see and play in. So, they bulldozed the dunes flat.

No one understood that these swells of sand may well have been what kept their home, hotel or favorite vacation spot from washing away during big storms and hurricanes.

Dunes, you see, are the first line of defense against the sea.

And that's a concept Sea Grant, the N.C. Division of Coastal Management and environmental groups have drummed into North Carolinians' heads during the last 25 years.

Now a developer or potential property owner wouldn't consider buying property that didn't have dunes hugging the beach.

In fact, Sea Grant coastal engineer Spencer Rogers, says, "North Carolinians now have a dune fetish. They know that dunes are a good thing to have and that they can offer substantial protection to their island home and development.

"And although we've successfully heightened awareness, the public has a perception that dunes do some things they can't do and never will do," Rogers says.

Rogers warns, for instance, that sand dunes do not stop day-to-day beach erosion. That kind of erosion is gradual and dictated by offshore events and shoreline processes.

But dunes do play a major role in slowing the erosion from big storms such as hurricanes and northeasters. They act as temporary protective barriers. But, they are not permanent structures that can hold off the ocean indefinitely.

"During storms, the more sand you have between you and the ocean, the more time it takes to wash it away," Rogers says.

And when it comes to storm protection, it's not the shape of the dune that counts. It's the volume of

Continued on next page.

Photo by Gene Furr

sand and maybe even the grain size of the sand that influence how long a sand dune will hold the ocean back, says Sea Grant researcher John Fisher.

Fisher and Margery Overton, two civil engineers at North Carolina State University, are studying the relationship between storm waves and dune erosion as part of a Sea Grant project.

The duo have experimented with simulation dunes at the U.S. Army Corps of Engineers Research Facility at Duck and in the Oregon State University wave tank.

Fisher and Overton learned that the height and frequency of the waves and the duration of a storm affect how fast a dune erodes.

"Now, I know those seem like obvious factors that you don't need a study to determine, but it's really more complicated than that," Fisher says.

By feeding dune and storm measurements into a mathematical model that Fisher and Overton are developing, they may soon be able to predict dune erosion for a given set of storm conditions.

And that's valuable.

Resource managers could predict which storms are likely to cause erosion and pinpoint areas that would be hardest hit. And the information could help property owners rebuild or reshape their dunes for better durability in the future.

If you're planning to build a dune, be it with sand fences or vegetation, Rogers has some tips.

Always build your dune well behind the line of vegetation. And, he says, if you have a deep lot, it's better to build your dune either underneath or immediately in front of your house as far away as possible from the beach.

Don't build your dune at the edge of the beach or build your house on or just behind a pre-existing beachfront dune if possible, Rogers warns. Dunes just off the beach are the first ones gnawed away by storm surf and surge.

"Just remember to put as much sand as possible between you and the ocean," Rogers says.

And before building any dune, check with your local Coastal Area Management Act permit officer. There are some specific regulations regarding dune building, especially with bulldozers. And other CAMA regulations govern how far behind the dune or first line of vegetation a house should be sited.

Above all, Rogers advises not to build a dune with a bulldozer or front-end loader.

"They're ineffective," he says. "They make property owners feel better, but they provide little or no actual protection because of where they're placed."

Bulldozed dunes are made of sand just pushed off the beach and placed well in front of the first line of the vegetation. They're too close to the ocean to provide any defense.

Besides, you can't just push a pile of sand in front of your house and expect it to stay there. Dunes need vegetation to hold them in place.

Sea Grant researchers Stephen Broome, Ernest Seneca and W.W. Woodhouse pioneered dune stabilization research in North Carolina 15 years ago.

Broome and Woodhouse, soil scientists, and Seneca, a botanist, learned that the roots and rhizomes of dune grasses and sea oats provide a skeleton for the dune that holds it stable. And the heads and stems of the vegetation trap wind-blown sand to gradually enlarge the dune.

Vegetation is extremely important to any dune system. That's why when

vegetation is destroyed by foot traffic, off-road vehicles or construction, it means more than dead plants.

When there are no dune grasses or sea oats to anchor the dune's sands, it blows away. Then, there's a hole in the dunes and the defense they offer. It's an open invitation for the ocean to come rushing in during the next big storm.

To prevent damaging dunes and their vegetation, use wooden walkways to access the beach. And don't drive ORVs on the dunes.

If you would like more information about building or repairing sand dunes with grasses and sea oats, write Sea Grant for a copy of **Building and Stabilizing Coastal Dunes with Vegetation.** Ask for UNC-SG-82-05. The cost is $1.50. This booklet was written by Broome, Woodhouse and Seneca.

Photo by Scott Taylor

Oh, Christmas Tree!

By Kathy Hart

Oh Christmas Tree, Oh Christmas Tree
How thick are your branches
They trap the wind and blowing sand
And make the dunes all strong again
Oh Christmas Tree, Oh Christmas Tree
How thick are your branches

It was a novel idea.

Instead of tossing the ol' Christmas tree out by the curb for the garbage men to pick up, why not put it to use—repairing the dunes.

That was exactly the idea Spencer Rogers had 10 years ago.

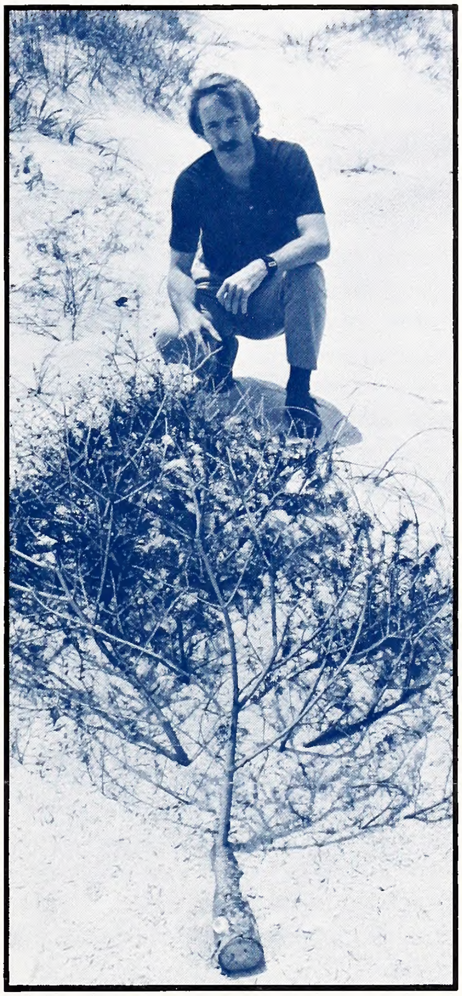
The Fort Fisher State Recreation Area had been flattened by dune-busting off-road vehicles. And the area was a sure bet for increased storm damage.

The recreation area needed to have its dunes repaired and rebuilt. But that could be an expensive proposition if the state had to use sand fencing or bulldozers.

Instead, Rogers suggested that they ask folks in New Hanover and Brunswick counties to bring their Christmas trees to Fort Fisher for some repair work.

Each year, no matter what the weather, several hundred people and their Christmas trees would show up at Fort Fisher on the first Sunday of the new year. Rogers would lead them out to the beach to help them position and stake their Christmas trees.

Then Mother Nature would take over. Strong winter winds would blow sand across the beach until it met the branches of one of the trees. There, it would pile up, often as much as one to two feet in just a few days. Later, vegetation would spread onto the new dunes and repair would be complete.



Altogether, Rogers and his volunteers planted more than 8,000 trees in 10 years.

The Christmas tree project, run in conjunction with the Fort Fisher Recreation Area and the N.C. Aquarium, was so successful that the job is done, Rogers says.

The dunes have been built back up to a safe, protective height. The state saved $55,000 in expensive sand fencing. And hundreds of volunteers have learned more about the value of our coastal dunes.

Dune Plants & Animals

By Nancy Davis

When you take a field trip to the dunes with Jeannie Kraus, the assignment is simple.

Just imagine what life would be like here.

Close your eyes. Feel the sun pounding down on you. Taste the salt spray as it settles on your lips, dries and robs your mouth of moisture.

Feel the wind as it does its best to make life miserable for you, alternately pelting you with sand, then whipping it out from under you.

Kraus' message: Life is rough on those mounds of sand just above the high tide. You might as well live in a desert.

Kraus is the natural science and education curator of the N.C. Maritime Museum, and she's the author of **A Guide to Ocean Dune Plants Common to North Carolina**, a book published by Sea Grant and the UNC Press.

Dune plants deserve respect, she says. After all, they've managed to adapt to one of the harshest of environments.

Next time you're tromping across the dunes to the beach, take a moment to reflect on how the plants manage to survive, she says.

Kraus reels off some of the conditions that dune life doles out:

- Salt spray that limits growth there to salt-tolerant plants
- Storm waves that uproot plants
- Coarse sand that is quickly drained of rainwater
- Few soil nutrients
- Intense sunlight that causes plants to dehydrate
- Extreme temperatures
- High winds that bury plants or expose their roots

Photo by Scott Taylor

"Plants that live on dunes have developed special adaptations to live there," Kraus says. "They can withstand a lot of wind, moving sand and getting washed over once in a while."

Back on the dune again, Kraus urges her students to examine the plants' leaves and stems for clues about how each survives the desert-like environment.

Notice how the blades of sea oats and beach grass are flexible enough to withstand high winds.

The waxy leaves of yaupon, wax myrtle and sea elder resist salt spray and help the plants retain moisture.

The prickly pear cactus stores water in its stem.

Next, notice that there's a pattern to where certain plants are located on a dune.

Closest to the beach, where waves frequently lap at the plants, you'll find the hardiest of plants—sea rocket, sea oats, beach grass and sea elder.

Between dunes where there's more protection, beach primrose, goldenrod, pennywort and wax myrtle can survive.

The further you get from the ocean, the less harsh the environment, Kraus says. Behind the dunes, some shrubs can survive.

Dune life is just as rough on animals as plants, Kraus says.

"Most animals are just passing through," she says, because they find life on the dunes too harsh and the food supply too limited to make it a permanent home.

But if you look closely enough, you may see ghost crabs poking out of holes in the sand and scurrying about for food. Twice a day, they head toward the water to wet their gills, Kraus says.

If there is sufficient shrub cover, you may notice some birds, such as painted buntings, warblers and sparrows, and field mice.

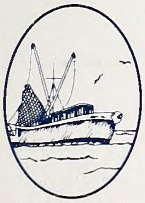
If you'd like to take your own field trip through the dunes, order a copy of **Ocean Dune Plants**. The 72-page illustrated guide provides an informative look at the ecology and biology of North Carolina's dunes.

Kraus identifies more than 50 trees, shrubs, vines, herbs and grasses. And she provides keys, brief descriptions and other facts that will help you identify dune plants.

For your copy, write Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695. Ask for UNC-SG-87-01. The cost is $4.50.

The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.



In late March, Sea Grant agent Jim Bahen and Varnamtown netmaker Steve Parrish tested four turtle excluder device designs at the U.S. Navy's David Taylor Research Center in Bethesda, Md.

The TEDs were tested in the Navy's flume tank, a long trough that circulates water. The Navy uses the tank to test ship hull and submarine designs. Bahen and Parrish were using the tank to see how TEDs worked underwater and to determine how shrimp loss could be minimized. The project was funded by the National Marine Fisheries Service.

Parrish had built scaled-down versions of four TEDs: the Georgia Jumper with an accelerator, a modified Matagorda TED, the original Parrish TED and a modified Parrish TED with an accelerator.

NMFS had approved the use of the accelerators, funnels made of webbing that increase the speed at which shrimp pass through the main body of the net to the tailbag. It was believed that accelerators shot shrimp past the TED opening created to extrude turtles.

Many Florida shrimpers had been installing the accelerators in their nets and claimed they reduced the loss.

The duo worked with Cliff Goudey, a marine engineering specialist of the Massachusetts Institute of Technology Sea Grant College Program, and a New England netmaker to run the tests and exchange ideas.

"We learned a lot," Bahen says. "We learned some techniques for fine-tuning the [excluder] opening and ways to minimize loss."

For bottom-extruding excluders, Bahen and Parrish found that floats need to be added to the headrope to lift the tailbag and extruder opening off the bottom. This change could make for an easier escape by the cumbersome sea turtles.

And, they found that exit holes could be sewn tighter to reduce shrimp loss but still allow turtles to exit.

Overall, Bahen and Parrish observed that top-extruding TEDs allowed too much shrimp loss. The force of water that swept across the top of the net gapes open the extruder hole, permitting shrimp to escape.

Now Bahen and Parrish will make some modifications in the TED designs to test this summer aboard *The Georgia Bulldog*, a boat operated by the Georgia Sea Grant College Program.

The National Marine Fisheries Service's Beaufort Laboratory is conducting research on sea turtles, and they need your help.

NMFS has distributed posters requesting beachgoers to report any sea turtle sightings. The posters contain pads of removable postcards for noting the date, location and species of turtle you see, whether the turtle was alive or dead, and whether it had been tagged.

If you're at the coast, look for the posters in the N.C. Aquariums, the N.C. Maritime Museum, dive shops, fish houses and bait and tackle shops.

Six species of Atlantic sea turtles are endangered. They include the Kemp's ridley, leatherback, hawksbill, olive ridley and the Florida breeding population of green sea turtles. All but the olive ridley have been spotted in North Carolina waters.

But the role of North Carolina's waters in sea turtle ecology is poorly understood. The NMFS project to obtain data on sea turtles here began in 1988. They want to know what turtle species inhabit Tar Heel waters and where they are commonly found.

If you see one of the NMFS posters, be sure to take one of the postcards. And if you see a sea turtle, dead or alive, and don't have one of the data cards, make some notes about the sighting, then call the NMFS Sea Turtle Project Coordinator at 919/728-3595.

If it's May, fishermen must be shedding blue crabs in coastal North Carolina. May is the month when virtually all blue crabs slip out of their hard exoskeleton. For a few hours, the crab becomes entirely soft and edible when cooked.

Blue crabs shed their shells to grow, but females must molt to mate. Females only reach sexual maturity during the last molt of their life. It's this mating response that makes soft crabs so numerous in May, especially around the full moon, crabbers say.

First the males shed in late April or early May. Then the females molt one to two weeks later, and the pair mates. If all goes as scheduled, the female carries the resulting eggs during the summer and releases them near the inlets in the early fall.

But some crabs don't adhere to the schedule. They mate later during the summer. Then, the female often carries the eggs throughout the fall and winter until the next spring before releasing them.

Although May is usually the month when shedding is at its peak, Mother Nature can rush the schedule if the weather warms earlier. And molting usually peaks a week to 10 days earlier in the southern and central coastal areas, says Wayne Wescott, a Sea Grant Marine Advisory Service agent.

But no matter when North Carolina crabs shed, they are always ahead of their northern neighbors in the Chesapeake. And this affords crabbers a top-dollar value for their soft crabs.

North Carolina crabbers also get the jump on another soft crab market—the one for "roaches." Small soft-shell crabs from 1½ to 3 inches wide are called roaches, and they are used in an exclusive hors d'oeuvres market in the North.

Crabbers find these roaches, also called "walk-ins," in their unbaited peeler pots during the very first days of spring. After crabbers shed the small crabs, they ship

continued on next page

them to New York, Baltimore and Boston, where they are the first fresh, live soft crabs on the market. Consequently, the crabs can bring up to $28 a dozen.

Sea Grant has computerized its mailing lists and publications inventory. The new system should help us process your requests more efficiently.

You can help us by providing your customer identification number when you order publications. The number appears just above your name on your *Coastwatch* mailing label.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Vol. 16, No. 5, May 1989. Dr. B.J. Copeland, director. Kathy Hart, editor. Nancy Davis and Sarah Friday Peters, staff writers.

Browsing the Sea Grant Bookshelves

What would summertime be without seafood? This month, the Sea Grant bookshelves feature a few of our most popular seafood selections.

To order, write Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605. Make checks payable to UNC Sea Grant. Indicate the publication numbers and include your customer identification number located above your name on your *Coastwatch* mailing label.

Seafood Poster colorfully charts the availability by month of the state's most popular fish and shellfish. UNC-SG-84-04; $2.

Recipes with a New Catch includes recipes for cooking 16 species of nontraditional fish—shark, triggerfish, bluefish, amberjack and more. UNC-SG-86-06; 40 pages; $2.

Hooked on Fresh Fish and Shellfish describes methods for determining seafood freshness. UNC-SG-85-08; 50 cents.

Bringing the Catch Home describes how to handle, prepare, transport and store fresh fish. UNC-SG-86-26; 50 cents.

Dressing Finfish illustrates methods for cleaning the catch. UNC-SG-86-10; 50 cents.

Flaking Fish shows how to flake fish for use in seafood dishes. UNC-SG-87-05; 50 cents.

Cracking into Crustaceans provides illlustrated instructions for cleaning shrimp and hard and soft crabs. UNC-SG-88-01; 50 cents.

Breaking into Bivalves provides illustrated methods for shucking oysters, clams and scallops. UNC-SG-88-02; 50 cents.

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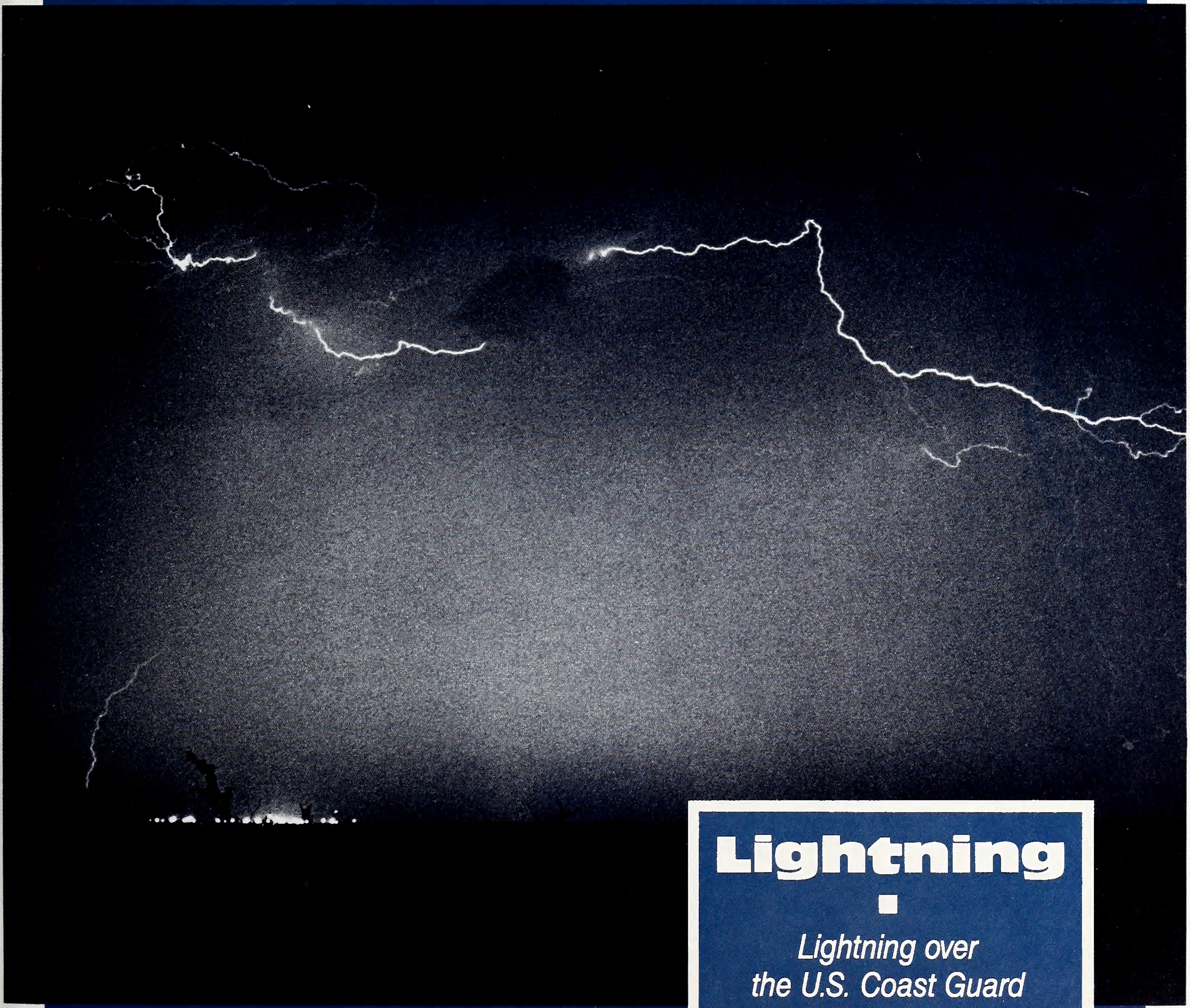


Photo by Scott Taylor

Lightning

▪

Lightning over the U.S. Coast Guard station at Fort Macon.

When lightning strikes

If Ben Franklin had known the risk he was taking when he sent his famous kite aloft in a thunderstorm, we might still be wondering about lightning.

The fact is, old Ben is lucky he didn't get fried in that experiment.

And lucky for us, he survived the shock to tell us that lightning is, in fact, electricity. In the process, he also invented the lightning rod.

BY NANCY DAVIS

Benjamin Franklin's bravery in the face of a storm eludes most of us. Nearly 250 years later, we're still awestruck by the clap of thunder and the flash of a jagged finger of lightning against a black sky.

And with good reason.

Lightning kills.

Nationwide as many as 100 to 125 people will die this year when they are struck by lightning. That makes it the second most deadly weather phenomenon after flash floods, killing even more people than hurricanes or tornadoes.

In North Carolina, about four people are killed and another 10 to 15 injured each year by lightning, making this the second most dangerous state for lightning. Only Florida records more lightning deaths.

In a single flash, lightning can kill people and livestock, smash a hole through a boat hull, destroy property and create fires that sweep through millions of acres of wilderness.

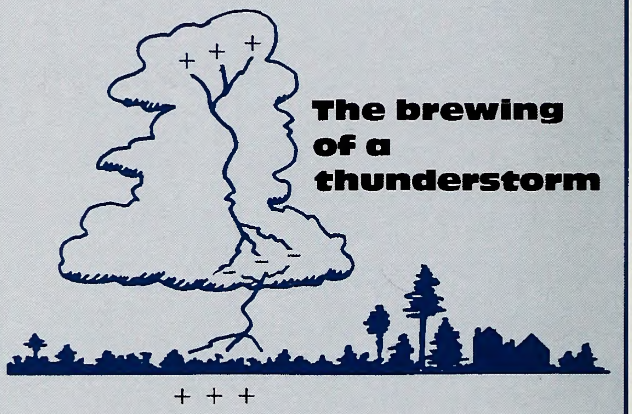
One bolt of lightning can pack as much as 10 million to 100 million volts of electricity. For comparison, an electrical outlet usually contains about 120 volts.

But lightning is also credited with creating life on Earth some 3 billion years ago. Scientists believe that electrical charges passing through gases in the atmosphere created amino acids that formed the building blocks of proteins, the basis for life.

As many as 16 million thunderstorms form around the world each year. And at any one time, about 2,000 of the storms are brewing.

In the United States, thunderstorms occur most frequently in the South Atlantic and Gulf states and in the Southwestern mountains, says Dave Eichorn, a forecaster with WRAL-TV in Raleigh.

North Carolina cities regularly record more than 40 days with thunderstorms each year. Raleigh, for example, averages about 45 thunderstorms a year. Wilmington records about 46 and Cape Hatteras, 47.



The brewing of a thunderstorm

When hot and cold air masses mix, a thunderstorm forms. The top of the cloud becomes positively charged, and the bottom negatively charged. The Earth's surface is positively charged. The air acts as an insulator until the voltage difference reaches 3 million volts per meter. Then lightning occurs.

Our prime months for thunderstorms are March through October, with June and July being the most active months, says Dennis Decker, a meteorologist with the National Weather Service at the Raleigh-Durham International Airport.

So far, recording thunderstorms has proved easier than explaining them. When the sky blackens, and a dark, ominous cloud looms overhead, there's

Photo from National Oceanic and Atmospheric Administration

a lot more going on than meets the eye, scientists say.

Inside that cloud, a complicated chain of events is in the works. And it's about to create the first bolt of lightning.

Vin Saxena, a physical meteorologist at North Carolina State University, explains how lightning forms.

Even in fair weather, there is an electrical field spread over the Earth, Saxena says.

For example, from your waist down, you are continually being bombarded with about 120 volts per meter of electricity—an amount similar to that in an electrical outlet. In industrial areas, the electrical field can be as much as 360 volts per meter, Saxena says.

But in a thunderstorm, the electrical field becomes exaggerated.

When hot and cold air masses mix, a thunderstorm starts brewing. The top of the thunderstorm cloud becomes positively charged, and the bottom negatively charged.

Down below, the positively charged surface of the Earth reacts to that law of nature that says opposites attract. The more negative the base of the cloud becomes, the more positive the Earth's surface becomes.

The air between the two acts as an insulator until the voltage difference reaches 3 million volts per meter.

At this point, the insulation breaks and lightning begins to form.

A line of current races from the base of the cloud toward the Earth, searching for the quickest way to the ground. It finds the tallest point—a tree, a radio tower, a church steeple.

The positive charge of the target leaps up to meet the negative charge from the cloud, creating a connection between the two and a blinding flash of light.

This is called the return stroke. And contrary to the popular belief that the flash moves from cloud to ground, it's the return stroke that's actually visible.

With the return stroke, the air becomes super heated, raising the temperature instantly to 30,000 degrees. By comparison, the sun's outer disk is 5,800 degrees. "That flash increases the temperature to five times the sun's outer disk," Saxena says.

The violent shock that the temperature creates results in the sound we hear and feel as thunder.

So far, that's just one bolt of lightning. Now the process starts again, and will happen over and over until the cloud and the Earth have neutralized their opposite charges.

"Lightning is nature's magnificent process of organizing all this energy," Saxena says. "In one thunderstorm

continued on next page

When lightning strikes

continued

spread over the size of the city of Raleigh, the energy of lightning could be as much as the atomic bombs of Hiroshima and Nagasaki."

Lightning comes in several forms, and it's named according to where the discharge takes place.

We're probably most familiar with the type that occurs between the cloud and Earth. But the discharge may also take place within a cloud or between clouds, without making contact with the ground.

Heat lightning is the term used loosely to describe lightning that is so far away that we can't hear its thunder.

"To somebody under that lightning, it sure wasn't heat lightning," Eichorn says.

With thunderstorm season upon us, you can be your own forecaster simply by observing a storm, Eichorn says.

The more intense it is, the more cloud-to-Earth lightning you will see, he says. If the cloud-to-Earth lightning begins to lessen and you see lightning only in the clouds, the storm is probably weakening, Eichorn says.

"Generally, the more lightning you have, the worse the storm," Eichorn says.

You can estimate the distance between you and a lightning flash by counting the seconds between seeing the flash and hearing the thunder, Eichorn says.

For every second you count, add 1,000 feet. For example, if it takes five seconds for the sound of the thunder to reach you, the lightning is about a mile away.

Studying lightning remains a difficult task for meteorologists. Lightning detection systems have been developed to help predict storms and pinpoint hot spots of lightning activity.

And Saxena says scientists know how to "seed" clouds so that they don't produce hail or electricity. But generally, the cost of such a process is prohibitive, he says.

So far, no one has figured out how to harness the potential energy in a thunderstorm.

"Maybe another Ben Franklin can put lightning to something useful," Saxena says.

Photo by Dave Eichorn

Chasing lightning

Dave Eichorn, a forecaster with a Raleigh television station, has a fascination for thunderstorms and especially lightning.

Before coming to Raleigh, Eichorn worked in Oklahoma. "I saw some thunderstorms that were absolutely incredible out there," he says.

Nearby transmitting towers made a great target for lightning, Eichorn says. And a lightning detection system allowed him to know where the storms were going to be. And most important, lightning occurs most frequently there at night, when it makes a brilliant display against a black background.

He was so taken by the flashy electrical displays that he began trying to capture the sight on film.

"When my shift was over, I'd hop in the car and, with the help of the lightning detection system, I'd go where the storm was," Eichorn says.

"It was like fishing for bass. Once you find one storm, there are usually others in the area. We used to chase them, and I'd take pictures."

After experimenting with his camera and film, he learned that if he kept the shutter open for 60 to 90 seconds at a time, he would eventually capture the sight on film. Now, Eichorn has a large spiral notebook filled with plastic sleeves of color slides of lightning.

At this point, Eichorn would warn folks not to try this experiment at home.

He knows lightning can kill, and he has a healthy respect for it.

"I'm pretty brave with lightning—braver than I should be," Eichorn says.

Photo from National Oceanic and Atmospheric Administration

Weatherwise or otherwise?

BY NANCY DAVIS

Outdoorsmen beware.

That includes all you golfers, boaters, swimmers, joggers and beachgoers.

You're more likely than most folks to get struck by lightning—particularly if you live or vacation in North Carolina during the summer months.

Although the Tar Heel state isn't a national leader in numbers of thunderstorms per year, it consistently ranks second in lightning deaths per year.

The reason?

Dennis Decker, a meteorologist with the National Weather Service in Raleigh, suspects the explanation is twofold.

First, with the long warm season, there are plenty of recreational opportunities here. That means more people are out on the golf course, in a boat or around a swimming pool during lightning season.

Second, since North Carolina is an agricultural state, more people are likely to be in open fields when a storm hits.

But if you spend a lot of time outside in the summer, take heart. Meteorological data tells us the odds of anyone being hit by lightning are about 1 million to one.

And if you are struck, there's a good chance you'll survive. Experts estimate two-thirds of those struck by lightning survive. Many of the victims that are assumed dead could actually be revived through cardiopulmonary resuscitation.

You can avoid becoming a lightning statistic by exercising a little common sense, Decker says.

As Ben Franklin once said, "Some people are weatherwise, but most are otherwise."

Because lightning often strikes without warning, the best advice is to take cover immediately. Don't wait to see if the storm is going to blow over.

If you're outside when a storm approaches, seek shelter in a building. If you're in a rural area and there's no building nearby, get in your vehicle.

"Make yourself as poor a target as possible," Decker says.

Don't take shelter near potential lightning targets such as fences or tall trees.

In many cases, nature will provide you with a warning that you're a lightning target. If you suddenly feel charged, your hair feels as though it's standing on end or your skin feels tingly, drop to your knees and bend over immediately.

Stay away from open doors and windows and out of the shower.

If you're in a boat on the water, your risk may be magnified. Not only does

continued on next page

Weatherwise or otherwise

continued

water conduct electricity well, but you will probably be the highest point around.

Whether you own a sailboat or a motorboat, the most important thing is to give lightning a ground.

Steel boats are automatically grounded by their hulls. But fiberglass or wooden boats need to be grounded to minimize the risk of lightning damage.

Some new boats will already be grounded when you buy them. Sea Grant marine agent Jim Bahen recommends you ask the dealer if the boat has been grounded.

If your boat hasn't been grounded, you can obtain instructions by writing Maryland Sea Grant, H.J. Patterson Hall, University of Maryland, College Park, Md. 20742. Ask for *Lightning: Grounding Your Boat*, Leaflet 138.

The next rule is to be weatherwise.

Obviously the best way to survive a storm is to stay out of it. Listen to weather reports before you leave the dock, says Bob Byrne, commander of the Morehead City Coast Guard Auxiliary Flotilla.

"If you know something is brewing, stay home," Byrne says.

But in some cases, stormy weather forms too quickly for warnings. If a storm takes you by surprise, Byrne recommends these steps.

Immediately secure any loose items on your boat. Most important, be sure everyone is wearing a personal flotation device.

"Don't leave them in the plastic or neatly tied up somewhere," Byrne says. "They won't do anybody any good there."

If your boat has a cabin, get inside. Then steer your boat toward the dock. Travel at a moderate speed, Byrne says.

If the storm overtakes you, drop back to minimum speed to avoid swamping your boat.

Zig-zag toward port, crossing the waves at 45-degree angles, Byrne says.

If lightning strikes your boat, the first rule is to recover, Byrne says. "Take two to three deep breaths first. You're going to be more scared than hurt. And if your boat has been properly grounded, your chances of getting hurt will be minimal," he says.

If someone is struck and appears dead, immediately give him mouth-to-mouth resuscitation and heart massage.

And even if a person seems merely stunned by lightning, he should see a doctor as soon as possible.

Lightning Safety Tips

Inside . . .

1. Stay away from open doors and windows.
2. Stay off the telephone and avoid using hand-held electrical appliances such as hair dryers, electric toothbrushes and electric razors.
3. Don't take a shower or bath during thunderstorms.

Outside . . .

1. If you're traveling, stay in your car. Automobiles offer good lightning protection.
2. If you don't have a car, take cover in a low area. Don't make yourself the highest point around.
3. Don't stand near tall, isolated trees, fences or other objects that might attract lightning.
4. Get out of and stay away from the water.
5. If you feel your hair stand on end, drop to your knees and bend forward.

If someone is struck by lightning . . .

1. Administer mouth-to-mouth resuscitation and heart massage, even if a victim appears dead.
2. Lightning victims should always see a doctor, even if they seem unhurt. The physical effects of a lightning strike aren't always obvious.

Fulgurites

When a bolt of lightning strikes a sandy beach, something amazing happens.

It creates glass.

The intense heat of the lightning instantly melts the surrounding sand, forming finger-like, hollow tubes of cemented sand.

They're called fulgurites, from the Latin word fulgur, meaning lightning.

Fulgurites are rough on the outside, smooth on the inside. They can be from a half inch to 2 inches in diameter and as long as 10 feet. But because they're so fragile, fulgurites are usually found in smaller pieces.

Most sand on North Carolina beaches is composed of two minerals—quartzite and feldspar. And quartzite contains silica, which is used to make glass.

Fulgurites are rare finds on North Carolina beaches, says Sea Grant educational specialist Lundie Spence. You're most likely to find them on high dunes after a rain. The rain washes away the loose surrounding sand, uncovering the fulgurites.

If you find one, handle it carefully, Spence says. Fulgurites are collector's items.

The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

Show everyone you're serious about clean waterways. Get a Big Sweep '89 T-shirt. The Big Sweep '89 is the successor to Beach Sweep. Because of the success of the coastal cleanup, we expanded it to include all of North Carolina's inland lakes and rivers. And to reflect that, we've changed the name to The Big Sweep.

The statewide cleanup is slated for Sept. 23. But show your support early by buying a T-shirt. The white T-shirts carry the blue and yellow sweeping logo across the front. The shirts are top quality and 100 percent cotton.

If you want a T-shirt, write Sea Grant, Box 8605, North Carolina State University, Raleigh, N.C. 27695. Or call 919/737-2454. The cost is $5, plus $1 for postage and handling. Makes checks payable to KNCCB/The Big Sweep.

The T-shirts are available in medium, large and extra large. Be sure to specify the quantities and sizes you want.

The money raised by selling the shirts will be used to produce educational materials such as posters, brochures and curriculum materials for teachers. Support The Big Sweep, and help clean up our waterways.

Lots of organizations and state agencies are hard at work on The Big Sweep '89.

This year, four groups join Sea Grant, the N.C. Division of Coastal Management, the N.C. Office of Marine Affairs/N.C. Aquariums, the N.C. Division of Parks and Recreation and N.C. 4-H in coordinating The Big Sweep.

They are the N.C. Division of Wildlife Resources, WRAL-TV in Raleigh, Keep North Carolina Clean and Beautiful, and Keep America Beautiful/Carteret County.

All this extra help should make The Big Sweep '89 a more successful and publicized event.

It took only four hours on a couple of Saturdays for America's beaches to come clean. But it also took more than 47,000 volunteers in 25 states and territories to make the difference.

The volunteers showed up for coastal cleanups from the Atlantic to the Pacific. In all they covered 3,518 miles of beaches. And they recorded each item they found for a national database compiled by the Center for Marine Conservation.

North Carolina's tallies from Beach Sweep '88 were included in more than 1 million items counted.

Altogether, 977 tons of trash were collected during beach cleanups last year. About 65 percent of it was plastic. Eleven percent was metal, and about 10 percent paper and glass. Plastic foam pieces ranked number one on the list.

The national database proved so successful that CMC will continue it annually. And they're considering expanding it to an international level.

For every snapper, grouper and king mackerel a recreational fisherman has reeled in, you can bet he's probably cast aside an amberjack, triggerfish or shark.

The reason? Well, more than likely, he just doesn't realize that amberjack can be just as tasty as king mackerel.

To change that, Sea Grant, the National Marine Fisheries Service and North Carolina State University's Department of Agricultural Communications have produced a television documentary on underutilized species.

Fishing for a New Catch, a 30-minute show, will air on the University of North Carolina Center for Public Television Sunday, July 23 at 7:30 p.m. and Saturday, July 29 at 12:30 p.m.

The video is aimed at the more than 8 million saltwater sport fishermen in the Southeast.

NMFS estimates recreational fishermen discard as much as 60 percent of the fish they catch because they don't consider them table fare.

To increase the use of these so-called undesirables, NMFS funded a study. Researchers from NCSU and East Carolina University surveyed fishermen from North Carolina to Texas to find out why they preferred some fish over others.

They found that if a fish didn't look "normal," it usually didn't make it to the cooler.

Fishing for a New Catch will help change those attitudes, says NCSU video producer Mike Gray. It will introduce fishermen to some of these less-favored fish, explain how to handle and clean them, and offer preparation suggestions.

In addition to the video, Sea Grant has developed a series of brochures showing how to catch, clean and prepare 16 underutilized species. And a cookbook, *Recipes with a New Catch*, is chocked full of delicious recipes for the fish.

If you would like the brochures, write Sea Grant and ask for the underutilized species brochure series. The cost is $2. For a copy of the cookbook, ask for UNC-SG-86-06. The cost is $2.

The N.C. State Museum of Natural Sciences Society is sponsoring a whale watch trip to Boston, Mass., July 20–23. Naturalists from the New England Aquarium will accompany the group on a whale watch excursion and will teach participants how to identify different species of whales and other marine life in the area.

The trip will also include a behind-the-scenes tour of the New England Aquarium.

The cost of the four-day trip is $579 for Society members, $619 for nonmembers, and $389 for children 16 and under who are accompanied by an adult.

To register, contact the Natural Sciences Society at 919/733-7450.

From Massachusetts to Hawaii, letters came—hundreds of them. Each requested the UNC Sea Grant publication, *Design and Installation of Low-Pressure Waste Treatment Systems.*

What spurred the requests? *Popular Science*, a national science magazine for interested laymen.

In its April issue, the magazine described how the low-pressure pipe (LPP) system can be used in areas where conventional septic systems will not work.

Almost 10 years ago, North Carolina State University soil scientists Bobby Carlile and Dennis Osborne developed the LPP system as part of a Sea Grant project. Conventional systems frequently failed in porous coastal soils, spewing sewage into the estuaries and contaminating water sources.

Coastal residents needed an alternative waste treatment system.

Under pressure from a pump, the system uniformly distributes wastewater into the soil at intervals. The soil dries between cycles, retaining its ability to purify waste.

The LPP allowed hundreds of coastal property owners to build on soils that previously had been unacceptable. And it provided the same benefits to inland property owners trying to treat sewage in the clay soils of the Piedmont.

Now news of this unconventional system has spread nationwide. If your septic system is failing or you plan to build on marginal soils, send for a copy of the LPP manual. Ask for UNC-SG-82-03. The cost is $3.

The booklet includes information on site and soil requirements, design, layout, equipment specifications, installation procedures and maintenance.

Sea Grant also published two other septic manuals—*Design and Installation of Mound Systems for Waste Treatment* and *Pressure-Dosed Septic Systems: Electrical Components and Maintenance.*

The mound system is a modified septic system designed for use in shallow soils that are not deep enough to properly purify effluent. To overcome this problem, the mound system uniformly treats effluent in fill material, using the same pressure-dosed strategy as the LPP. The mound manual is $2.50, and its publication number is UNC-SG-82-04.

The electrical component manual describes dosing controls and accessories suitable for pressure-dosed septic systems. It describes how to select, install and maintain them.

This manual should be used as a supplement to the LPP and mound manuals. Its publication number is UNC-SG-85-06. The cost is $3.

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Coastwatch

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Photo by Scott Taylor

TRASHING THE OCEANS

By Sarah Friday Peters

Kuzu. Abfall. Ordures.

No matter how the speakers said it at the Second International Conference on Marine Debris, the words all meant the same thing.

Trash.

The speakers came from 11 different countries, but they spoke the same language as allies against plastics and marine litter.

For a week in April in Honolulu, Hawaii, the group learned that trash has no boundaries with the oceans as its highways.

For most, the story was the same.

Researchers Zoe Lucas and C.W. Ross of Nova Scotia found 90 percent of the items they picked up in a Sable Island study were plastic.

On six Mediterranean Sea beaches, Abraham Golik of the National Institute of Oceanography in Israel collected trash in a study earlier this year: 71.6 percent was plastic.

Russian packaging washed ashore on New Zealand beaches.

South American products anchored in Africa.

And a Chilean detergent bottle floated to North Carolina's Outer Banks.

No doubt plastic debris is a global marine pollutant that inflicts ever-increasing environmental and financial costs, says Jim Coe of the National Marine Fisheries Service in Seattle, Wash.

No doubt solutions must take an international perspective, too.

But too many questions stand in the way of answers now, the experts say. Researchers, technologists, economists, educators and policy-makers are just beginning to address problems associated with marine debris.

Four years ago, the first marine debris conference consisted mainly of scientists who found entangled birds or plastic pieces en route to other research.

Now counting those birds and collecting that plastic is the main focus of their research.

Peter Ryan has had his eye on birds for years.

The South African ornithologist says seabirds such as albatrosses eat more plastics than any other group of animals. Most often they mistake the debris for food such as shrimp.

The amount of plastic that birds ingest corresponds to the density of debris at sea, Ryan says. With those numbers increasing, he's worried about seabird populations.

Ingested plastics can physically damage a bird's digestive tract, his studies show. Some contain toxic compounds such as lead, mercury and PCBs. In addition, if a bird's stomach fills with plastic, there's no room for real food. And the plastic they don't digest can sometimes be regurgitated or "offloaded" to their chicks.

Bird nests tell the same story, says Richard Podolsky, an ornithologist at the Island Institute in Rockland, Maine.

Of 497 double-crested cormorant nests he examined visually, 188 or 38 percent had plastic in them. When some of the nests were dissected, the incidence of plastic was much higher—70 percent.

Photo by Scott Taylor

So far, Podolsky's data indicates the nests reflect the amount of debris floating into the area.

"There's more of it out there than we've all seen," Podolsky says. "It can have a long-term effect on the population."

The same thing can happen to fish, sea turtles, Northern fur seals, dolphins, whales, sea lions and other marine animals.

Incidents of plastic ingestion and entanglement are widespread. Yet data is sketchy because most of these animals move from place to place.

Keeping count of the trash is easier.

Scientific studies provide a window to the world of waste. And beach cleanups like North Carolina's Beach Sweep have become part of a national effort to pinpoint types and sources of marine debris in the United States.

Last fall during beach cleanups in 25 states and territories, 47,500 volunteers picked up 976 tons of trash. And they recorded each piece on data cards from the Center for Marine Conservation. The results comprised the first National Marine Debris Database.

So far, 65 percent of the items counted were plastic. Eleven percent were metal; 10 percent, paper; and 9 percent, glass.

Foam plastic pieces topped the list. Plastic pieces, plastic cups and utensils, metal beverage cans and foam plastic cups followed.

Not all the trash can be categorized by source, says CMC's Kathy O'Hara. But of the items identified most were galley-type wastes from boats and cargo ships. Fishing and boating gear came in second.

Less than 1 percent of the items found were medical wastes.

But that was enough to keep thousands of vacationers away from New York and New Jersey beaches last summer.

In Long Island, 18 percent fewer people basked at the beach, resulting in a $921 million loss in tourism revenues, reports Kathryn Wagner of the Office of Technology Assessment in Washington, D.C.

New Jersey beaches saw an 8 to 34 percent decrease in attendance and a $745 million decrease in revenues, Wagner adds. Lost tourism and the increased costs of monitoring the beach hit hard.

The looming threat of medical debris and marine litter raises hairs in other coastal communities, too. And rightly so, Wagner says. Without change, an economic impact on vessels and shorelines is evident.

Implementation of Annex V of the MARPOL (Marine Pollution) Treaty should help. The ocean dumping law that went into effect last December prohibits the disposal of all plastics in the ocean and requires vessels to take such trash back to port.

The U.S. Navy is doing its part, too. By April, it reported a 70 percent decrease in plastics going to sea.

Teachers, port authorities, environmental groups, commercial fishermen, federal and state governments and others are joining the forces.

Even the plastics industry is cleaning up its act.

Companies are pouring millions into new technologies for degradable plastics and recycling. And the Society for the Plastics Industry, Inc., a national trade association, is working with CMC to educate the industry and the public about problems associated with marine debris.

Worldwide, such efforts will make the difference. And that's good news—no matter how you say it.

TURNING TRASH AROUND

By Kathy Hart

Let's face it, America. We're a throwaway society.

In a wealthy nation rich in goods, almost everything is made to be disposable—diapers, paper plates, plastic cups, razors, lighters, cans, even contact lenses.

Use something once, maybe twice, and it's garbage. Plunk it in the trash can and push it out by the curb. Or, the less conscientious toss it out the window, drop it overboard or leave it behind.

Rep. John D. Dingell, chairman of the U.S. House Energy and Commerce Committee, says, "The age of disposables, from diapers to fast-food packaging, is leaving our communities awash in a sea of garbage."

In last year's beach cleanup of the Tar Heel coast, volunteers picked up thousands of disposables—8,346 soft drink bottles, 1,068 fast food containers, 11,238 beverage cans and 2,471 paper cups.

And North Carolina's beach cleanup totals are just the tip of an iceberg that may sink this nation in its own refuse. Consider these facts from the Environmental Defense Fund:

- Each American produces half a ton of garbage a year.
- Americans go through 2.5 million plastic bottles every hour.
- We trash enough office and

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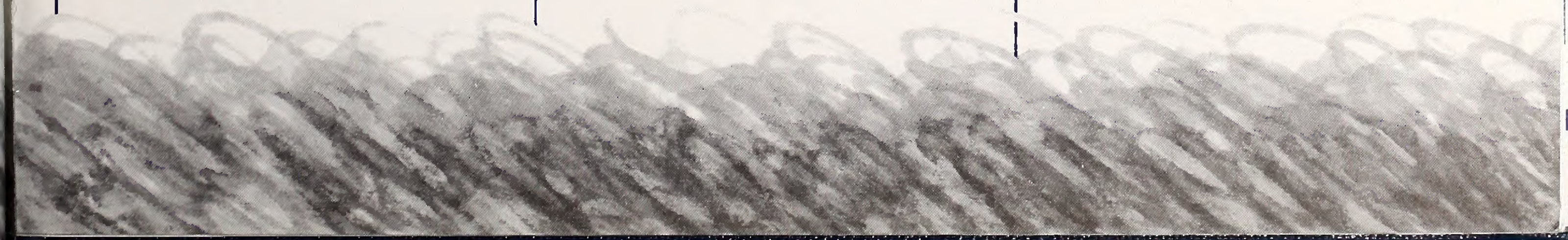

writing paper annually to build a wall 12 feet high from Los Angeles to New York City.

- We throw away enough glass bottles and jars to fill the 1,350-foot twin towers of the World Trade Center every two weeks.
- We discard enough aluminum to rebuild our entire commercial airline fleet every three months.

All of these disposables are adding up to a heap of trash—160 million tons—and a national garbage bill that totals more than $10 billion. Current waste disposal practices mean 80 percent of it will be buried in landfills and 10 percent burned in incinerators.

But what about the rest?

It's recycled—meaning it is reprocessed, reformed and reused. It's not lying in a landfill.

And that's what has city, county and state officials excited from coast to coast. Many landfills are near capacity, and with land prices skyrocketing, municipalities are hard pressed to find a place to bury their rubbish.

That's why we see wandering garbage barges on the nightly news and municipal refuse rolling ashore with the incoming tide.

But recycling offers hope. It saves money, energy and natural resources.

Moneywise, recycling saves dollars that would otherwise have to pay for the burial or burning of refuse. And it can generate income. Paper, aluminum, glass and plastic can be sold to recycling companies.

From an industrial standpoint, using recycled materials requires less energy than raw materials. According to the Environmental Defense Fund, making a can out of recycled aluminum takes only 5 percent of the energy needed to make an aluminum can from raw material.

And recycling conserves natural resources such as forests and saves habitats.

But most folks think recycling means only glass, aluminum and paper. However, plastic can be recycled, too, says Barry Appelget of Mountain Polymers, a plastic recycling company in Greensboro.

Plastic soft drink bottles and milk jugs can be reformed into flower pots, carpet pads, toys, hose pipe and fill for pillows.

Plastic recycling is a fledgling industry, but one that is growing fast, Appelget says. And no wonder. There is plenty of plastic to recycle.

Appelget says 57.2 billion pounds of plastic are produced in the United States every year, and 15 billion pounds of that is one-time-use packaging.

Needless to say, much of that plastic ends up in our garbage. By volume, 25 percent of all trash buried in landfills is plastic.

And the qualities that make plastic so popular—light weight, durability and strength—also mean that it can take more than 400 years to degrade.

Although plastic's longevity counts against it in the landfill, it's a positive factor for recycling. Its durability and strength mean it can

Photo by Scott Taylor

All of these items can be recycled.

be melted and reformed over and over again, Appelget says.

But only 1 percent of the plastic produced in the United States is recycled. Appelget is trying to increase those figures.

His company is processing 5,000 pounds of plastic a day or enough plastic per week to fill a one-acre landfill 8 feet deep.

But for Appelget's company and others like it to succeed, they need plenty of used material. And that means folks need to separate out their recyclable refuse.

Some local governments, such as Charlotte, Durham and Raleigh, have begun recycling programs.

In Charlotte, residents are provided with a special 10-gallon "curb it" container in which to place plastic soft drink bottles, glass and aluminum beverage cans. Newspapers are placed in paper bags on top of the containers.

According to the Center for Plastic Recycling Research, results from the pilot project showed that at least 74 percent of the eligible households in Charlotte were recycling regularly.

Other city and county governments in North Carolina and nationwide are following suit. Presently, at least 600 U.S. municipalities pick up recyclable materials at the curb. Others have designated drop-off bins.

If your town doesn't have a recycling program, you can still reduce your refuse by taking some items to the nearest buy-back center. Most centers accept glass, aluminum, tin cans and newspapers.

Some also accept magazines, aluminum foil and scrap, corrugated cardboard, paper bags, phone books, wood and plastic containers. Check with your buy-back center to see how you can make a difference.

TAKE IT FROM THE KIDS

By Nancy Davis

When the camera panned on a remote beach piled high with trash, the audience stared stone-faced.

When they watched a baby sea lion struggle to free itself from a fishing net, they raised their eyebrows.

When the scene flashed to a seabird strangled in a plastic six-pack yoke, they winced.

But a sea turtle with a plastic bag protruding from its mouth brought gasps and looks of disgust from the audience.

"Ooh." "Gross." "Yuck."

Those were the reactions from a classroom full of sixth-graders—some of the very people who one day will be entrusted with the fate of our seas.

They were also some of the folks Sea Grant and other state agencies had in mind when we began sponsoring a statewide beach cleanup three years ago.

Sure, we wanted to rid the coast of trash, says Sea Grant marine education specialist Lundie Spence, the Big Sweep coordinator. But we also wanted to raise awareness of the litter problem on our beaches and to change people's bad habits.

We figured if we educated kids about the problem, they'd grow up to be more responsible citizens.

"It's the standard cliche that the students of today will become the voters of tomorrow. But that statement carries a lot of weight," Spence says.

"We adults think that kids aren't concerned about the environment," Spence says. "But ask a kid what he thinks about littering. You'll find they have an awareness of the problem."

Spence was right. *Coastwatch* recently visited a sixth-grade science class in Wake County. And if their comments are any indication, these kids will take good care of the coast.

"I went to the beach last weekend, and I was looking for shells. But I found a lot of glass and trash, too," Aaron says.

"Our society is so lazy," Leslie says. "If there's a trash can on the beach next to them, they'll still toss their trash right on the ground."

"We're a society of convenience," Beth says.

"People think that leaving their trash on the beach doesn't matter," Anna says. "It saves them time. But it all builds up."

"Yeah," says Andrew. "People don't realize that the water can come up and carry all the waste out to sea."

Andy Wood, education curator at the North Carolina Aquarium at Fort Fisher, believes the best age to teach kids about their environment is the fifth grade. But even three-year-olds aren't too young to learn, he says.

"They can develop a sense of responsibility," he says. "It's important to approach kids early so they

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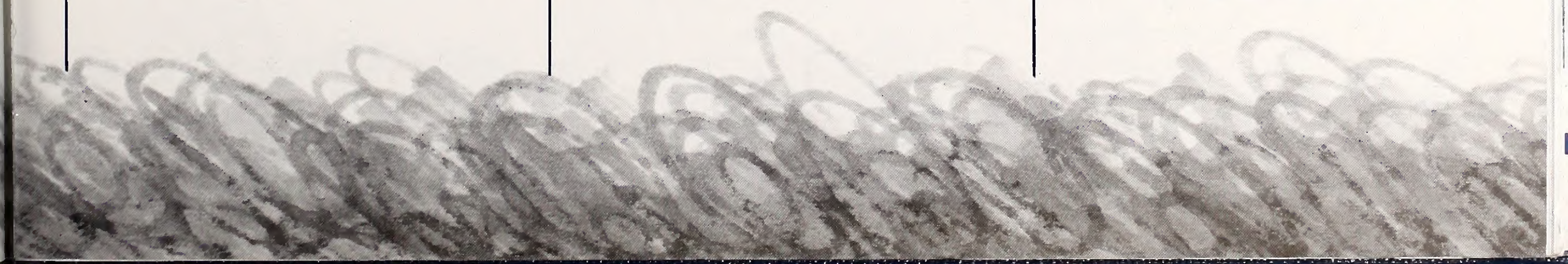


develop a positive attitude about themselves and their planet."

"Once they get a little older, they start to set a pattern. They're exposed to kids with other philosophies. If we wait too long, they may already have something ingrained in their minds. They may already have a lackadaisical attitude about where they put their garbage," Wood says.

Wood focuses his programs on marine debris towards children, with the hope that he'll also reach their parents.

"So when that parent pulls up to a traffic light and dumps his ashtray in the street, the child may tell the parent, 'Hey, wait a minute. Don't do that.' So we're able to approach adults through children. Sometimes adults won't listen to other adults, but they'll listen to kids," Wood says.

Evidently, Wood is right. Sixth-grader Becky says if she saw her parents littering, she'd reprimand them. And if she saw a stranger drop trash on the beach? "I'd give them a dirty look, and then I'd pick it up," she says.

Anna says, "If I saw someone littering, I'd tell them that animals are dying because you're doing this."

Andrew would have another approach. "I'd pick it up and ask them why they did that. Then I'd give them reasons not to do that again," he says.

The students also had some recommendations for reducing litter on the beaches.

Anna believes local beach communities should pitch in more. She says, "On some beaches, we should have more trash cans. If there are more there, people might use them more."

Andrew says we should "pass some more laws against dumping trash."

"If you see trash on the beach, take it back and help clean up," Courtney says.

Mark believes it's all a matter of getting the word out. "We should put advertisements on plastic bags—'Save the ocean.' And then people might think about it more," he says.

But even for all their concern and sage advice, every now and then, the innocence of a sixth-grader was replaced with a touch of cynicism.

Becky put the problem most succinctly when she said, "There's always gonna be somebody who doesn't care. There's always gonna be some business or some people who just don't care."

But Becky adds, "When we grow up and we get into offices like governor and stuff, . . .we can do a lot more about it."

THE BIG SWEEP

Volunteer for The Big Sweep today!

Join others Sept. 23 for the nation's first statewide waterway cleanup. To volunteer, pick your favorite North Carolina beach, lake or river. We'll supply the litter bags; you bring gloves, a hat and sunscreen. For cleanup locations, call our Telecom USA toll-free hotline 1-800-27SWEEP between 8 a.m. and 5 p.m. Monday through Friday.

And show your support early by ordering a Big Sweep T-shirt. The white, 100 percent cotton shirts carry the blue and yellow sweeping logo across the front.

The T-shirts come in medium, large and extra-large sizes. Mediums are great for kids. Be sure to specify the quantities and sizes you need.

To order yours, send $5 plus $1 for postage and handling per shirt to Sea Grant. Make checks payable to The Big Sweep-KNCCB.

Concerned kids pick up trash in last year's beach cleanup.

Photo by Scott Taylor

The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

Be one of a first. Join other volunteers on Sept. 23 for the nation's first statewide waterway cleanup. Help pick up litter from Nags Head to the Nantahala River or just about any lake or river in between for The Big Sweep '89.

Formerly Beach Sweep, The Big Sweep will cover North Carolina's coastline and inland waterways. From 9 a.m. to 1 p.m., volunteers will collect trash and record each piece on data cards. The tallies will be compiled into a national data base in Washington, D.C.

Any groups or individuals can participate. Just choose your favorite beach, lake or river and call the Telecom USA Big Sweep Hotline 1-800-27SWEEP.

And while you're out by the water, wear a T-shirt bearing The Big Sweep logo. The yellow swoosh with blue lettering covers the front of the 100 percent cotton shirt. To order yours, send $5 plus $1 for postage and handling per shirt to Sea Grant. Make checks payable to The Big Sweep-KNCCB.

The Big Sweep '89 is coordinated by Sea Grant, Keep North Carolina Clean and Beautiful, WRAL-TV, N.C. 4-H Program, N.C. Wildlife Resources Commission, N.C. Aquariums, N.C. Division of Coastal Management, N.C. Division of Parks and Recreation, and Keep America Beautiful/Carteret County.

Sea Grant has just installed a new computer inventory and data base system that will help us keep better track of our newsletter and publication customers.

In transferring from one computer system to another, it's possible that some errors may occur on your mailing label. If so, just write *Coastwatch* and notify us of any changes you would like made. Please include your new customer identification number that appears on the mailing label of this issue of *Coastwatch*.

Hurricanes, severe storms and extreme flooding rarely occur in Eastern North Carolina. But there's always a chance they will.

Living on the sound, river or oceanfront increases the chances of property damage or loss from flooding. So for most coastal property owners, having flood insurance pays off.

Typical homeowner insurance policies don't cover damage caused by rising water from coastal storms, erosion, stream flooding or stormwater runoff, says Spencer Rogers, Sea Grant's coastal engineer. If you want flood insurance coverage, you need a separate flood insurance policy.

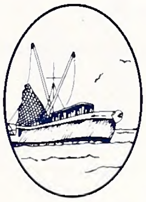
Flood insurance is required for most mortgages in flood-prone areas, Rogers says. And it is recommended for coastal property owners in threatened areas.

But such insurance can be expensive.

That's why Rogers recently wrote *Saving Money on Flood Insurance for Coastal Property Owners*. This 12-page booklet outlines construction techniques and building modifications that can reduce the annual cost of flood insurance premiums. And it explains little-known details in the flood insurance program that can help you and your insurance agent optimize rates.

As an example, one building style typical of coastal construction is described and modified to show the effect on annual flood insurance premiums.

Saving Money on Flood Insurance is a helpful guide for prospective builders, current homeowners or designers at the coast. For copies, send $1 to Sea Grant and ask for publication number UNC-SG-89-05. And be sure to use your customer identification number, which appears on *Coastwatch*, when ordering.



In May, all shrimp boats 25 feet or longer trawling in ocean waters were required to pull turtle excluder devices in their nets.

Since then, many fishermen using TEDs have complained of reductions in trawl efficiency and in shrimp catches.

But now, North Carolina fishermen can get help fine tuning their TEDs. With the help of a grant from the Gulf and South Atlantic Fisheries Development Foundation, Sea Grant marine advisory agent Jim Bahen and Varnamtown fisherman Gerald Ivey will work with fishermen having TED troubles.

The purpose of the project is to minimize the impact to fishermen of the transition to TEDs, Bahen says.

Jerry Schill, executive director of the N.C. Fisheries Association, is encouraging fishermen to call Bahen for help with their TEDs.

"We're trying to teach fishermen how to install TEDs and how to fine-tune them. That's what this grant is for. We think their problems of shrimp loss and damage to their nets will be minimized through this grant," Schill says.

Many fishermen are installing TEDs on their vessels for the first time. And improper installation can affect the performance of a shrimp trawl, Bahen says.

If you need help installing a TED or fine-tuning one already on your boat, call Bahen at 919/458-5498. Either Bahen or Ivey will assist you as soon as possible.

The juniors and seniors in New Bern Senior High School's coastal biology class did more than study science last year. They published a book. *Seafood for Thought* is a 144-page paperback book about North Carolina's bountiful seafood harvest.

The book is organized around the seafoods we pull from our Tar Heel waters, including everything from oysters and clams to octopus and squid.

continued next page

Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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☐ Mass media
☐ Seafood processing/marketing
☐ State government
☐ University professor/researcher
☐ Other____________________

Coastal property owner: ☐ yes ☐ no Boat owner ☐ yes ☐ no

$__________ contribution to defray printing costs for *Coastwatch*

To compile the book, the students interviewed fishermen, seafood dealers and marine biologists. And they included several recipes for each species.

For your copy of the book, write New Bern High School, 2000 Clarendon Blvd., New Bern, N.C. 28560. The cost for *Seafood for Thought* is $8.

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Coastwatch

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A recipe for a healthy tomorrow

less salt • less fat • less cholesterol • more seafood

Please don't pass the salt

BY NANCY DAVIS

Joyce Taylor is shaking the salt habit.

When the Sea Grant seafood education specialist is in the kitchen, she thinks twice before she reaches for the shaker.

And more often than not, she's cooking seafood without a grain of salt.

Instead, she tosses in a few well-selected herbs and spices to serve as substitutes.

"Salt is a habit. And I've always been a saltaholic," Taylor confesses. "But when I cut back on it, I was amazed at how good food tasted."

Taylor became convinced that salt could be eliminated from most seafood recipes without a loss of flavor after a year of experimenting in the kitchen.

She began the work because of the emphasis on reducing sodium in our diets. Contrary to popular belief, seafoods are actually low in sodium. But it's the salt we often add in the preparation that turns a food that's good for us into one that's not so healthy anymore.

And because she always touted seafood as *the* health food, Taylor wanted to be sure her recipes could withstand the scrutiny of health-conscious consumers.

Table salt is a combination of sodium and chloride. And it's the sodium that is actually the health concern.

We all need some sodium to live, but because it occurs naturally in so many foods, there's really no need to add it to our diet.

But most of us do.

In fact, much of the sodium we eat comes from ordinary table salt we use in cooking or sprinkle on at the table.

All the evidence isn't in yet, but most medical experts agree that we could all do with a lot less sodium.

The American Medical Association estimates that more than 19 million adults in this country have high blood pressure, a condition that increases the risk of heart attack, stroke and kidney failure.

Salt may not cause high blood pressure, but it can make the condition worse. That's why physicians often recommend their patients with high blood pressure and those with a family history of the disease restrict their sodium intake.

The American Heart Association goes a step further, recommending that everyone restrict salt consumption.

The Food and Nutrition Board of the National Academy of Sciences has established a daily intake of 1,100 to 3,300 milligrams of sodium as "a safe and adequate" range. Many experts suggest reducing this to 1,000 milligrams or less a day.

That's where Taylor figured she could help make a difference. "It may not do you any good to reduce your salt intake, but it certainly couldn't hurt," she says.

She began experimenting with low-salt seafood recipes a year ago. For help, she called on a group of health, food and nutrition leaders in Carteret County to serve as an expert taste panel.

The nutrition leaders represent extension homemaker clubs in the county. Taylor conducts monthly workshops with the leaders, who then pass on what they've learned to their clubs.

Taylor began by pulling seafood recipes from books, magazines and newspapers. Then she tried to adapt low-salt versions of the recipes.

"We weren't out to create new recipes," she says. "We just wanted to find a substitute for the salt."

At first, reaction to the healthier versions of the recipes was less than enthusiastic.

But, after a year of testing and retesting, Taylor is confident the recipes they ended up with are good—even if you're usually liberal with the salt shaker.

The first step in making the recipes healthier was to eliminate all table salt from the list of ingredients, Taylor says.

In the place of salt, Taylor substituted herbs, spices, citrus juices and table wines. Cooking wines weren't acceptable because they contained added salt.

Herb Chart

There are no rules for substituting herbs for salt in recipes. Here are a few suggestions. Don't be afraid to experiment.

BASIL	BAY LEAVES	CHERVIL	DILL	FENNEL	MARJORAM
Crab	**Court Bouillon**	**Garnish or Seasoning for all Seafoods**	**Flounder**	**Bass**	**Clams**
Mackerel	**Flounder**		**Grouper**	**Flounder**	**Crab**
Salmon	**Salmon**		**Salmon**	**Grouper**	**Mackerel**
Shrimp	**Snapper**		**Scallops**	**Shrimp**	**Salmon**
Snapper			**Shrimp**		**Tuna**
Trout					
Tuna					

There were no hard and fast rules for the substitutes. Instead, Taylor and her team of nutritionists used a trial-and-error method. They found that certain substitutes complemented some fish and shellfish better than others.

Some herbs that blended well with seafood included basil, bay leaves, dill, marjoram, oregano, parsley, rosemary, sage, tarragon and thyme.

Next, Taylor changed all butter in the recipes to unsalted margarine. Garlic powder or fresh garlic was substituted for garlic salt, and fresh minced celery took the place of celery salt.

Celery is one of the foods that naturally contains a high amount of sodium. But the quantities are still much lower than table salt. When added to a recipe, celery imparts much of that sodium flavor into the food, at a safer level.

If you're trying to cut back on salt, Taylor has plenty of advice.

Most important, read labels. Most packaged foods have the amount of sodium, in milligrams, printed on the label. Avoid processed foods since they are usually high in sodium.

Be aware that many seasonings are really nothing more than flavored salt. In lemon pepper, for example, salt is the first ingredient listed, meaning it's the most abundant ingredient.

When a recipe calls for a commercial seasoning blend, usually high in salt, mix your own, Taylor says. Try a blend of cayenne pepper, celery seed, nutmeg, coriander and paprika. A fourth of a teaspoon of each, with just an eighth of a teaspoon of cayenne, will serve just as well as the commercial blend.

Other commercial seasonings to avoid include: garlic salt, onion salt, commercial bouillon, meat tenderizers, soy sauce and monosodium glutamate.

If a recipe calls for crackers or bread crumbs, use the low-sodium versions that are available now.

Taylor admits that, in some cases, you'll have to compromise. One of the recipes she experimented with called for unsalted canned tomatoes. But the recipe got bad reviews.

So rather than give up on it, Taylor and her nutritionists bent the rules a bit. They used 2 cups of unsalted tomatoes and 1 cup of salted tomatoes.

Getting rid of at least some of the salt is better than nothing, Taylor says. If you must, start by cutting back on salt, then work your way up to a total elimination, she says.

Taylor has compiled the successful no-salt recipes into a cookbook that will be available soon. The cookbook includes only the recipes that received an excellent rating from her taste panel.

For a flavor of the recipes in the book, Taylor offers these recipes. None of them contain any added salt—only what occurs naturally in the food or in small quantities in the ingredients. For your copy of the cookbook, write Sea Grant. Ask for *No-Salt Seafood*, UNC-SG-89-07. The cost is $3.50.

Mackerel with Herb Seasoning

¼ cup unsalted margarine, melted
1 tablespoon fresh lime juice
⅛ teaspoon Tabasco sauce
1 tablespoon minced fresh parsley
1 teaspoon minced fresh thyme
1 teaspoon minced fresh marjoram
½ teaspoon pressed garlic
¼ teaspoon cayenne pepper
¼ teaspoon paprika
⅛ teaspoon ground cloves
4 medium mackerel fillets or other fresh fillets
½ cup coarsely chopped green onions, including tops

Combine melted margarine, lime juice and Tabasco sauce. In a small bowl, combine all other seasonings except onions. Place fillets in greased baking dish. Brush margarine mixture over fillets. Sprinkle onions on fillets, then herb seasonings. Bake at 400 F about 10 minutes or until fish flakes easily with a fork. Serves 4.

Broiled Snapper with Lemon Sauce

2 pounds fresh snapper fillets or other lean fillets
3 tablespoons fresh lemon juice
2 tablespoons unsalted margarine, melted
freshly ground black pepper
¼ cup vegetable oil
½ teaspoon dry mustard
1½ teaspoons water

Place fillets in oiled baking dish or nonreactive pan. Brush with one tablespoon lemon juice. Brush with margarine and season with pepper. Broil 4 inches from heat for 10 to 12 minutes or until fish flakes easily when tested with a fork.

While fish is cooking, combine oil, mustard, water and remaining lemon juice. Blend well. Heat and pour over cooked fish. Serves 6.

Scallops over the Campfire

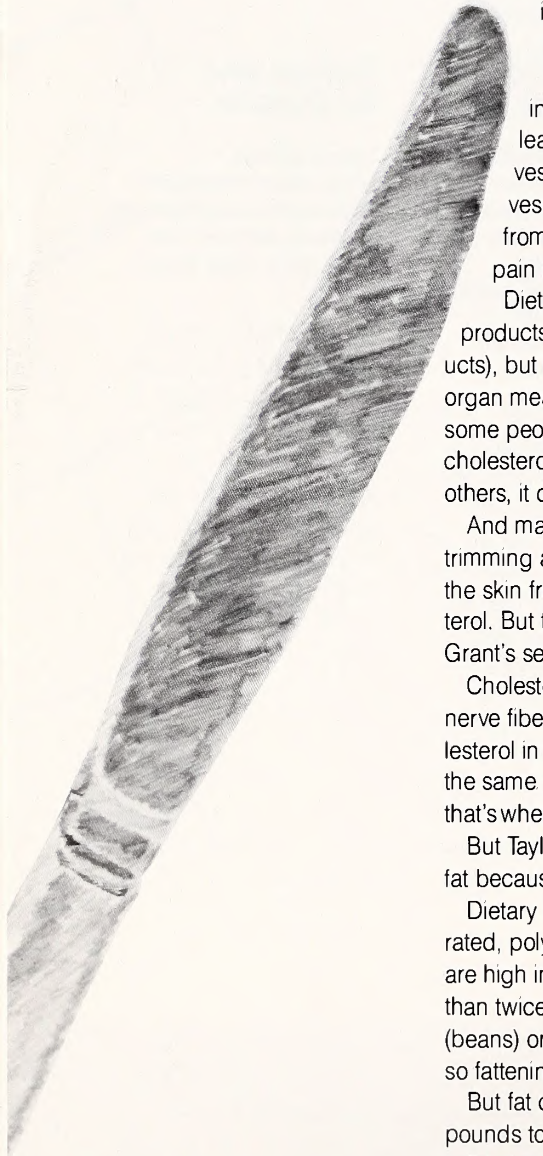
1 pound scallops
½ cup chopped mushrooms
¼ cup unsalted margarine, melted
1 teaspoon fresh lime juice
freshly ground black pepper
paprika

Pat scallops dry. Punch holes in heavy aluminum foil and place scallops on foil. Top with mushrooms. Pour margarine over. Sprinkle with lime juice, pepper and paprika. Grill about 10 minutes over hot coals until scallops are tender. Serves 4.

OREGANO	PARSLEY	ROSEMARY	SAGE	SUMMER SAVORY	TARRAGON	THYME
Clams	**Garnish or Seasoning for all Seafoods**	**Mackerel**	**Crab**	**Crab**	**Crab**	**Crab**
Crab		**Salmon**	**Flounder**	**Flounder**	**Flounder**	**Flounder**
Flounder		**Snapper**	**Salmon**	**Salmon**	**Grouper**	**Mackerel**
Lobster			**Snapper**		**Lobster**	**Scallops**
Oysters					**Oysters**	**Snapper**
Shrimp					**Shrimp**	**Tuna**

Cutting the fat and cholesterol

BY KATHY HART



Eat right.

We hear it from the surgeon general, the American Heart Association, our physicians and, yes, our own mothers.

But what does it mean?

Generally, you should eat a variety of foods, but avoid too much fat, saturated fat, cholesterol and salt.

You know about salt (see story, page 2). But what about fat, saturated fat and cholesterol?

We hear or read these terms daily. But what do they mean to our health?

Cholesterol is a fat-like substance found naturally in the human body and in foods from animal sources. The cholesterol produced in our bodies is blood cholesterol. It is used every day in the production of hormones and the maintenance of cell structure.

But high levels of blood cholesterol increase the risk of heart disease. It leads to the buildup of fatty deposits on vessel walls and the narrowing of blood vessels. This keeps oxygen-carrying blood from getting to the heart, causing chest pain and heart attacks.

Dietary cholesterol is found in all animal products (meat, poultry, fish and dairy products), but is especially high in egg yolks and organ meats (liver, kidney and sweetbreads). For some people, the consumption of dietary cholesterol boosts their blood cholesterol; for others, it doesn't.

And many people mistakenly believe that by trimming away fat from red meat and removing the skin from poultry, they are eliminating cholesterol. But they are wrong, says Joyce Taylor, Sea Grant's seafood education specialist.

Cholesterol is found in the cell membranes and nerve fibers of animals. The concentration of cholesterol in the lean tissue and fat in meat is about the same. Since most meat is primarily lean tissue, that's where most of the cholesterol is concentrated.

But Taylor still recommends that folks cut away fat because it does reduce saturated fat.

Dietary fat comes in a variety of forms—saturated, polyunsaturated and monounsaturated. All are high in calories: nine per gram. That is more than twice the calories found in a gram of protein (beans) or carbohydrates (pasta). That's why fat is so fattening.

But fat can do more than just add a few extra pounds to your weight. Saturated fat, fat that is solid at room temperature, actually stimulates the production of blood cholesterol in your body.

In fact, saturated fats are believed to be more likely than dietary cholesterol to raise the blood cholesterol in your body.

Some people mistakenly equate saturated fat with only animal fat. Animal fat (meat fats and butter, cream, whole milk and some cheeses) is high in saturated fat, but so are some vegetable oils.

Palm kernel oil, palm oil, cocoa butter and coconut oil, vegetable oils widely used in crackers, chips, cookies, cake mixes and granola bars, are more highly saturated and more harmful to your health than beef fat.

Polyunsaturated oils are liquid at room temperature and vegetable in origin. Corn, cottonseed, soybean, sunflower and safflower oils are high in polyunsaturates. Monounsaturated oils are soft at room temperature and also vegetable. Canola and olive oils are high in monounsaturates.

Polyunsaturated and monounsaturated oils are thought to lower blood cholesterol, but some scientists have recently disputed their healthful effects. Now, scientists believe the real key to lowering cholesterol levels is omega-3 fatty acids. Omega-3s are most abundant in the oils of fish and shellfish, particularly oily, fatty fish.

The presence of omega-3s is one reason the American Heart Association recommends that Americans eat seafood two to three times a week. And the association still recommends polyunsaturates and monounsaturates over saturated fats.

But when it comes to some polyunsaturates, there's a problem. Food companies often hydrogenate polyunsaturated oils in a process that solidifies or partially solidifies them. This renders these ingredients more saturated. But hydrogenated polyunsaturated oils are still less saturated than coconut or palm kernel oil.

And there's another complication. No vegetable oil is 100 percent polyunsaturated or monounsaturated. All contain some saturated fat.

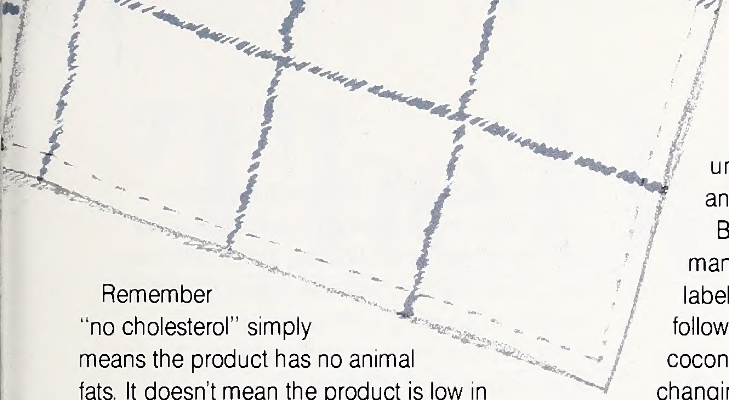
So how do you choose an oil? Look for oils that have a high unsaturated/saturated fat ratio. Canola oil, now proclaimed the healthiest oil on the market, has the best unsaturated/saturated fat ratio: 15.7/1 (see table for other ratios).

When buying snack or processed foods, look beyond the "no cholesterol" or "vegetable oil" claims prominently displayed on the package.

Unsaturated/Saturated Fat Ratios for Vegetable Oils

Canola	**15.7/1**
Safflower	**9.6/1**
Sunflower	**8.6/1**
Corn	**6.4/1**
Soybean	**5.9/1**
Olive	**5.8/1**
Peanut	**4.6/1**
Sesame seed	**4.4/1**
Cottonseed	**2.7/1**
Palm kernel	**0.2/1**
Coconut	**0.1/1**

Source: Tufts University *Diet & Nutrition Letter*



Remember "no cholesterol" simply means the product has no animal fats. It doesn't mean the product is low in saturated fat. In fact, if palm kernel or coconut oil is among the ingredients on the label, the product is high in harmful saturated fats.

And don't be fooled by "vegetable oil" claims. Coconut, palm kernel and palm oils are vegetable oils, but they're also high in saturated fats.

Manufacturers use these saturated vegetable oils because they don't easily go rancid or impart an off flavor. And it's often cheaper to buy palm oil from Third World countries than to buy the unsaturated oil crops of corn, soybean and cottonseed from U.S. farmers.

But food oil prices fluctuate, and sometimes manufacturers buy domestic oils. That's why labels often read: "contains one or more of the following: soybean, cottonseed, palm and/or coconut oil." This eliminates the expense of changing labels when manufacturers switch oils, but it leaves consumers in a quandary about the foods they eat.

All in all, the American Heart Association recommends a low saturated fat, low cholesterol diet for everyone.

The association suggests limiting dietary cholesterol to no more than 300 milligrams a day. And people are encouraged to reduce total fat intake to 30 percent of their total daily calories and consumption of saturated fat to less than 10 percent.

Eat seafood to your heart's content

BY KATHY HART

All of this talk about fats and cholesterol should send folks running to the seafood counter. Why?

Because all seafood is low in fat and saturated fat, and most is low in cholesterol.

For instance, compare the fat and saturated fat in 3½ ounces of cooked ground beef (82 percent lean), light meat chicken, gray trout and shrimp in Table 1.

The seafood clearly falls at the bottom of the chart in fat and saturated fat content. This translates into fewer calories and less cholesterol in the bloodstream.

Table 1.

Fat Content in grams per 3½ oz. cooked portion.

	FAT	SATURATED FAT
cheddar cheese	**31.4**	**2.1**
ground beef (82% lean)	**16.8**	**7.0**
2 large eggs	**11.2**	**3.4**
loin pork chops	**10.4**	**3.6**
top round steak	**6.9**	**2.5**
canned white tuna	**6.4**	
chicken, light meat (without skin)	**4.5**	**1.3**
mullet	**2.9**	**1.1**
gray trout	**2.8**	**1.1**
bluefish	**2.0**	
clams	**1.7**	**0.3**
shrimp	**1.4**	**0.2**

Sources for Tables 1 and 2: National Marine Fisheries Service, U.S. Dept. of Agriculture and J.A. Nettleton's *Seafood Nutrition*

When it comes to cholesterol, finfish and most mollusks (clams, oysters, mussels and scallops) are low in cholesterol. But blue crab, shrimp and lobster are higher (see Table 2). And squid and fish roe are even higher.

That's why the American Heart Association recommends that folks on low cholesterol diets limit their intake of shrimp, blue crab and lobster to once a week.

All shellfish were once thought to be high in cholesterol, says Joyce Taylor, Sea Grant's seafood education specialist. But recent advances in analytical equipment allowed scientists to measure only cholesterol. As a result, the cholesterol count for oysters, clams and scallops dropped significantly.

But Taylor says that consumers should also consider the size of their servings. The cholesterol counts in Table 2 are for 3½-ounce servings.

"No one eats only 3½ ounces of shrimp or blue crab," Taylor says. "That amount only whets your appetite. Most people eat twice or three times that amount, and they're consuming two to three times as

Table 2.

Cholesterol in milligrams per 3½ oz. cooked portion

chicken livers	**745**
calf liver	**440**
2 large eggs	**428**
brown shrimp	**157**
blue crab	**120**
ground beef (82% lean)	**100**
loin pork chop	**91**
chicken, light meat	**85**
croaker	**54**
flounder	**50**
red snapper	**40**
scallops	**40**
mullet	**21**

continued on next page

much cholesterol."

Taylor says folks also add saturated fat, cholesterol and calories to their fish and shellfish during preparation. She discourages frying the fisherman's catch, but realizes that some people are hooked on fried fish.

If you must fry, Taylor recommends canola oil or safflower oil. Try to avoid shortening or lard because they are high in saturated fat.

Be sure to heat your oil before adding the fish, Taylor says. The fish cooks faster and absorbs less oil.

Also, Taylor suggests that fried fish addicts use fillets for frying instead of cutting fish into fingers. With fillets there is less surface area to absorb oil.

And any time you fry, drain your fish on paper towels to absorb more oil from the surface.

But Taylor wishes everyone would throw out their frying pan when it comes to fish and shellfish. Other cooking methods—baking, broiling, poaching, steaming, grilling and stir-frying—make for more moist, more flavorful fish that has fewer calories and saturated fat.

Poaching and steaming fish in water or wine requires no oil. For baking, grilling and broiling, Taylor recommends brushing the fish with canola oil instead of butter or margarine.

And marinades are a good way to add flavor without adding too much fat.

Taylor says the following recipes are healthful ways to prepare the catch.

Oriental Fish Marinade

1 pound flounder or other lean fillets
6 tablespoons light soy sauce
1 tablespoon vegetable oil
1 teaspoon finely minced fresh ginger
1 clove garlic, pressed
1 teaspoon honey
1 teaspoon vinegar
2 tablespoons water

Place fish in a flat, nonreactive pan. Mix other ingredients in a bowl and pour over fillets. Marinate 30 minutes. Remove fish and reserve marinade.

Grill or broil fish about 4 inches from heat source until fish flakes easily when tested with a fork, about 8 to 10 minutes. Baste occasionally with marinade. Serves 3.

Grilled Herbed Sea Bass

8 sea bass or other fillets
vegetable oil
freshly ground black pepper
1 tablespoon finely chopped fresh basil
1 tablespoon finely chopped fresh thyme
6 tablespoons finely chopped fresh parsley
1 cup coarse dry bread crumbs

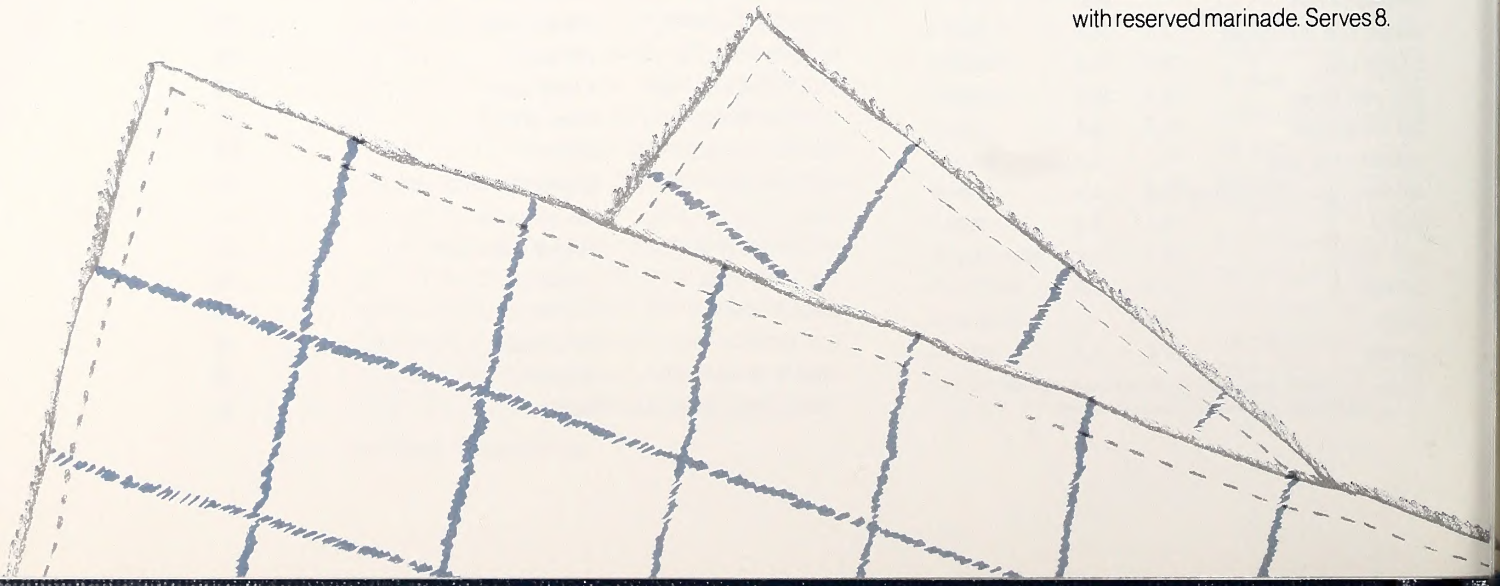
Brush fillets lightly with oil and sprinkle with pepper. Combine other herbs in a bowl. Press a coating of herbs, then bread crumbs, firmly into the fish on both sides. Transfer fish to an oiled, hinged grill. Grill over hot coals for about 4 to 5 minutes or until the crumbs are brown on one side. Turn carefully and cook on other side. Serves 8.

Indonesian Grilled Shrimp

2 tablespoons fresh lemon juice
1 tablespoon fresh lime juice
¼ teaspoon cayenne pepper
½ teaspoon ground coriander
3 tablespoons molasses
1 large garlic clove, pressed
2 teaspoons grated lemon peel
2 tablespoons vegetable oil
2 pounds shrimp, peeled

Stir together all ingredients except shrimp. Place shrimp in marinade for 30 minutes, turning occasionally.

Remove shrimp from marinade and thread them on metal or wooden skewers. (If using wooden skewers, soak them in cold water for 1 hour before grilling.) Reserve marinade. Grill about 4 inches from hot coals until lightly browned, about 4 minutes on each side, brushing with reserved marinade. Serves 8.



The Back Page

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On again, off again, on again. That best describes the regulations governing turtle excluder devices, or TEDs, during the summer of '89.

The devices designed to expel sea turtles from shrimp nets stirred a hotbed of controversy.

And as a result, it has been a summer that has found Secretary of Commerce Robert Mossbacher in court and Gulf shrimpers blocking access to some ports in protest.

Environmentalists are pushing the federal government to enforce regulations that require shrimpers to install TEDs in their nets. They believe that without the TEDs, hundreds of endangered sea turtles will be caught in nets and drown.

But shrimpers say the same holes cut to expel turtles also allow their catch to escape. They say the shrimp escape is so great that it is putting them out of business.

To appease environmentalists and uphold the Endangered Species Act, Mossbacher reinstated the TED regulations, but with a few changes to appease fishermen, too.

The new regulations state that shrimpers must either use TEDs in their nets or participate in synchronized shrimping.

And what is synchronized shrimping?

It's a schedule of times when all shrimp boats without TEDs can and can't have their nets in the water. Tow periods last 105 minutes; rest periods, 30 minutes. Any boat towing for shrimp during the rest periods will be stopped to see if they are pulling TEDs.

The U.S. Coast Guard and the National Marine Fisheries Service enforcement officers are enforcing the regulation.

These regulations remain in effect until Sept. 7. Meanwhile, Mossbacher heads back to federal court to justify the new regulations.

So, stay tuned for the next installment of "As the TED Turns."

From North Carolina to Texas, fishermen say TEDs are losers when it comes to shrimp.

They claim all of the different TED designs expel turtles and lots of shrimp, too.

But Sea Grant agent Jim Bahen and Varnamtown netmaker Steve Parrish have been hard at work to correct this flaw.

The duo began their work with miniature TEDs in the Navy's flume tank—a test tank for ship and submarine designs. After hours of testing and yards of videotape, Bahen and Parrish came back to North Carolina with a better idea of how TEDs worked underwater.

That's when the changes began. Parrish modified his own design, the Parrish soft TED, and another design that used a metal grid to deflect the turtle out of the net.

Then Parrish and Bahen headed to Georgia for a real test aboard *The Georgia Bulldog*, a research and testing vessel operated by Georgia Sea Grant.

The TEDs were installed one at a time in a 65-foot, two-seam shrimp net, a standard net used for brown shrimp in North Carolina. As a control, no TED was placed in the other net towed by the trawl.

In nine tows alongside Georgia's shrimp fleet, the TED nets either netted as many or more shrimp than the control net without the TEDs.

"The modifications reduced shrimp loss significantly," Bahen says.

To prove how well the modified TEDs worked, Bahen placed an underwater video camera in the net. He now has footage that shows how the TEDs work underwater, how they reduce shrimp loss and how they expel turtles.

Bahen is assembling the footage into a video that he will have available to show fishermen early this fall. For more information about the modified TEDs or the video, call Bahen at 919/458-5498. Or stop by his office at the N.C. Aquarium at Fort Fisher.

Sea Grant marine advisory agent Jim Bahen has developed *Recreational Guide to Management of Fish in South Atlantic Waters.* The guide provides current biological data and the latest state and federal regulations for popular species of fish found off the North Carolina coast.

The one-page guide is a handy reference for any recreational fisherman.

For your free copy, write Sea Grant. Ask for UNC-SG-89-06. And when ordering, be sure to use the customer identification number that apears on your *Coastwatch*.

When students in the Australian Outback go to class, they don't take a bus or catch the carpool. They turn on the radio. Some youngsters from kindergarten to middle school live so far out on sheep and cattle ranches that they can't go to school easily. So teachers broadcast lessons daily over the radio.

Seeing "The School of the Air" was just one fascinating adventure for 17 North Carolina teachers taking part in the Australia Institute July 6 to 26.

The three-week workshop in Queensland gave teachers the chance to learn how life Down Under compares to life back home. They investigated educational systems and ecosystems, explored the Great Barrier Reef, conducted experiments and discussed global environmental problems with Australian scientists.

One of the highlights was an afternoon watching wallabies feeding and preening, says Lundie Spence, Sea Grant's education specialist and one of the program's coordinators. Some of the native marsupials even had joeys in their pouches.

The teachers spent time snorkeling over different types of reefs from the fringing

continued next page

reefs off Orpheus Island to the patch reefs 30 miles offshore.

They visited Australian schools and saw "The School of the Air" in action. And they learned about environmental problems confronting Australians in Queensland such as deforestation, oil drilling in the Great Barrier Reef, rising sea level and management of fish and shellfish resources.

In addition, the Tar Heels tasted steak and kidney pies, talked with commercial fishermen, and yes, heard an occasional "G'day mate."

The program was sponsored by UNC Sea Grant, the University of North Carolina at Charlotte, and the Massachusetts Audubon Society. Ten teachers received scholarships for the trip from the N.C. Math and Science Educational Network.

Teachers can explore other worlds down under with a copy of Coastal Geology. The 121-page North Carolina Marine Education Manual takes a look at the geology and geography that make up the Coastal Plain.

The easy-to-use workbook was developed by public school teachers and university professors to help science teachers incorporate marine lessons into their curricula. The book is geared toward middle- and junior high school classes but can be adapted to other grades.

Coastal Geology covers plate tectonics, coastal plain sediments, continental shelf geology, barrier island and estuarine geology and ecology. Each section includes background reading and a comprehensive list of references and resources.

In addition, the book includes more than 25 classroom activities such as "Making Marine Fossils" and the "Plate Tectonic Puzzle."

For a copy, send $3.50 to Sea Grant and ask for UNC-SG-78-14A.

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Photo from N.C. Division of Archives and History.

Was This Fort Fisher's Last Stand?

Fighting A New Foe.

By Nancy Davis

Drive south on Highway 421 as far as you can go.

You'll end up on the southernmost tip of New Hanover County on a narrow strip of land that's bordered by the Cape Fear River on one side and the Atlantic Ocean on the other.

It's on that piece of shifting sand that Confederate soldiers constructed Fort Fisher, one of the largest earthen forts ever built. It was to guard the lower Cape Fear River and keep the port of Wilmington open to the blockade runners that supplied the South.

And it did its job until the final days of the war, when Yankee soldiers, far outnumbering the Confederates, finally seized it.

Now, 125 years later, the fort is under seige again. But this time, the enemy is the sea.

The Atlantic Ocean is relentlessly bombarding the historic fort. And with every wave, history is washing away.

Gehrig Spencer, Fort Fisher historic site manager, estimates the sea has claimed as much as 80 percent of the earthworks. And in a last-ditch effort, he and other historians are trying to keep what's left of the fort from falling into the sea.

"At the current rate of erosion," Spencer says, ". . . Fort Fisher as it is will not be available to future generations."

The erosion at Fort Fisher was actually caused by a natural phenomenon; it wasn't man-induced, says Spencer Rogers, Sea Grant's coastal engineering specialist.

The beach runs north-south. Originally, the fort crossed the peninsula from the river to the ocean and then went south in the shape of a figure 7 along the oceanfront.

To the north of the fort, a rock outcropping, rare in North Carolina, occurs just along the shore. The outcropping has created a barrier for sand moving from north to south. Sand has accumulated to the north of the outcropping, but disappeared from the beach adjacent to Fort Fisher.

So far, most of the earthen mounds along the oceanfront have disappeared, leaving only the section of the fort that crosses from the river to the sea.

To some, the battle plan is obvious: build a seawall to protect the earthen mounds.

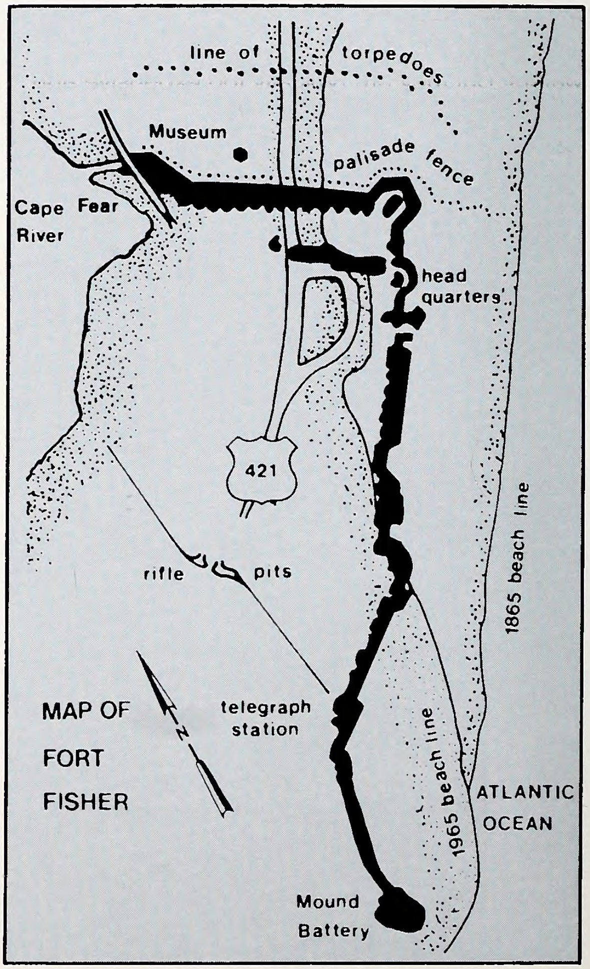
In 1982 the U.S. Army Corps of Engineers designed a $7 million rock revetment, similar to a seawall, to protect what remains of the historic site. It would be about 3,050 feet long and would be composed of a sloping pile of granite rocks.

But there's a catch.

In 1979, the state outlawed hardening of the shoreline. That includes bulkheads, seawalls and revetments. Although these structures sometimes preserve the immediate property, they often rob sand from the beaches on either side. And North Carolina law aims at preserving beaches, not structures.

But Fort Fisher presents a kink in that strategy. The law was written with provisions for variances to be granted.

So far, that hasn't happened. "No variance has



ever been granted since the no-bulkheading law went into effect," says Robin Smith, assistant attorney general with the N.C. Attorney General's office.

Rogers says the Fort Fisher case presents the extreme of both sides of an erosion issue.

Historians argue that the fort's cultural value far outweighs the value of maintaining adjacent beaches. But on the other extreme, conservationists say that granting a variance could set a precedent and lead to more hardening of the state's shoreline.

But most of the other erosion control methods just won't work at Fort Fisher, Rogers says.

There are typically six options for dealing with erosion, he says.

1. Don't locate a structure in high-erosion areas. But it's too late for that option since the fort is already in place.

2. Move it. That's been proposed to save the famed Cape Hatteras Lighthouse. Moving the lighthouse is a viable option, but moving an earthworks fort is not.

3. Install sand traps, such as groins or breakwaters. But they are typically too expensive and don't provide protection from major storms.

The Atlantic Ocean is relentlessly bombarding the historic fort. And with every wave, history is washing away.

4. Nourish the beach. But at Fort Fisher, the erosion rate averages 10 feet per year. Tom Jarrett, with the Corps of Engineers, estimates beach nourishment would cost $23 million more than the revetment.

5. Take no action, and let the sea claim it—obviously not an option favored by historians.

6. Harden the shoreline.

The issue of hardening the shoreline often revolves around the adjacent beaches.

Fort Fisher is located at the end of a developed stretch of Kure Beach and just before several miles of state-owned beach.

If a revetment were installed, it would probably result in a slight increase in the erosion rate for the beach south of Fort Fisher, Rogers says.

This rubble is all that stands between the ocean and the fort.

But it wouldn't be a big loss, he adds, because there's so much public beach available. And, Fort Fisher is not a safe place for swimmers anyway. Rip currents occur there frequently.

In the end, "It's a matter of weighing the trade-offs and consequences," Rogers says. "What is the least wrong answer?

"The question then becomes, 'Is the historic value of the fort worth the reduction of the beach in front of the fort and a slight increase in erosion farther south?' " Rogers says. "The clear choices are either preserve the fort and lose a small amount of beach or preserve the beach and lose the fort."

The proposed revetment isn't the first attempt to save Fort Fisher.

Concrete and brick rubble from the demolition of a nearby industrial plant was placed along portions of the shoreline. And in the early 70s, a small revetment was constructed along most of the rest of the shoreline.

But that structure gradually failed and has settled onto the beach.

Now the state is under the gun to make a decision about the $7 million revetment. The state must pay for half of the project. And Corps projects are deauthorized if no federal money is spent within 10 years of approval of the project.

Jarrett says the Fort Fisher project must be under way by 1992 or the review and approval process must begin again. That costly process could take as long as 10 to 15 years.

And time is not on Fort Fisher's side, Gehrig Spencer says. The historic fort can't hold out much longer. Soon it may be in the hands of the enemy.

Gibraltar Of America.

By Sarah Friday Peters

On Dec. 24, 1864, Union soldiers headed for New Inlet with one thing in mind.

They were to seize one of the last Confederate forts that protected the thriving port of Wilmington.

But something stood in their way.

Fort Fisher.

From the flat lands of the beaches loomed the largest earthwork fortification in the South. Like a giant in the forest or pyramids in the desert, Fort Fisher awed them.

And they turned back.

The famous fort fell later, but remained one of the most important and unique structures from the Civil War.

Unlike other forts built of brick and mortar, Fort Fisher was built by hand with earth and sand.

And its strategic location played a vital role in the protection of Wilmington and the entire Confederacy.

Today trees and vegetation cover the remaining mounds.

In 1860, Wilmington was a commercial hub that boasted a population of nearly 10,000. In wartime, it became the last major port open to the Confederacy, and the destination of steamers, called blockade runners, that smuggled provisions to Southern troops.

These ships traveled to Bermuda, the Bahamas and Nova Scotia to exchange cotton and tobacco for food, clothing and munitions from British traders.

Keeping in the war for the Confederacy meant keeping Wilmington's accessways open.

Since 1826, Fort Caswell had protected one entrance to the port.

But New Inlet, which had been carved by a hurricane in 1761, remained defenseless.

Strategic command for securing the Cape Fear River from attack was placed in the hands of Maj. Gen. W.H.C. Whiting of Wilmington. Fort design and engineering became the task of Col. William Lamb, also of Wilmington.

Lamb envisioned a fort that could not be taken. So he modeled Fort Fisher after a Russian fort that survived three years of onslaught during the Crimean War.

Troops and slaves began construction in May 1861.

First they built approximately 14,000 square feet of underground bombproof shelters, powder magazines and tunnel works. Then they piled sand mounds on top and stacked mud from the marsh around them for support. Timbers reinforced gun platforms.

In the end, Fort Fisher resembled the figure 7. It ran 680 yards from west to east and 1,800 yards south. The massive mounds averaged 32 feet in height. The tallest reached 60 feet.

Forty-seven cannons stood guard. And a nine-foot tall palisade fence ran from the river to the ocean on the land face.

On Dec. 24, 1864, the "Gibraltar of America" got its first test.

Union forces knew the capture of Fort Fisher would open the river to federal gunboats and make the other Confederate camps easy to occupy.

The Union planned to blow up Fort Fisher with a boat loaded with 215 tons of powder. At 1:45 a.m., that boat, the *Louisiana*, exploded with little more than a fizzle and left the fort unharmed.

Undaunted, the Union Army charged ashore and advanced toward Fort Fisher.

Photo from N.C. Division of Archives and History.

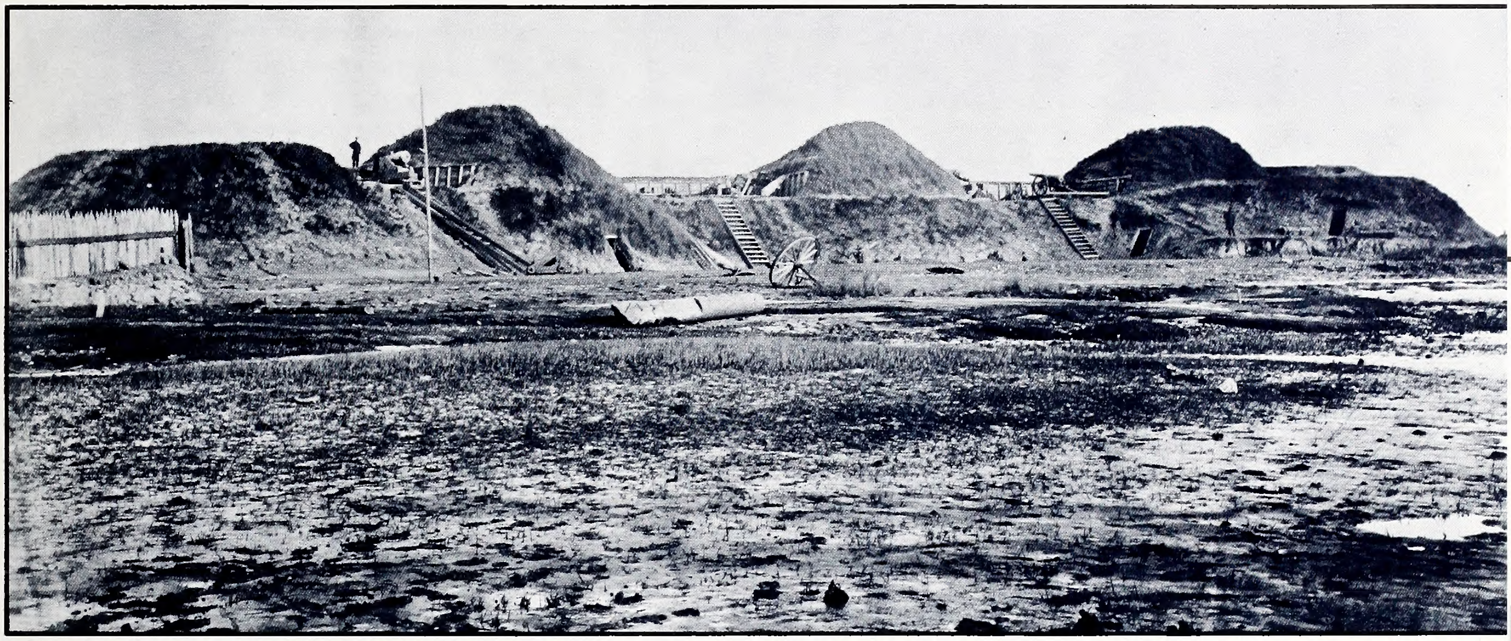


Photo of Fort Fisher taken more than a century ago.

But before Gen. Benjamin Butler brought in his troops, he sent engineers to survey the fort.

What they saw amazed them.

The fort's looming defenses prevented direct assault, they said. So the troops turned around.

Only 800 Confederate troops guarded Fort Fisher that day. Six thousand more were camped five miles away at Sugar Loaf, but never moved in to help.

From the flat lands of the beaches loomed the largest earthwork fortification in the South. Like a giant in the forest or pyramids in the desert, Fort Fisher awed them.

Whiting and Lamb expected a second attack soon. Troops repaired parts of the fort, got more ammunition and doubled their numbers.

On Jan. 13, the Yankees came back.

Fifty-eight warships carried 600 cannons and 8,000 men.

The Union Army moved in. Then the Navy.

At 3 p.m. on Jan. 15, the sailors and marines attacked Fort Fisher on the ocean side. Then the Army came in from the river side.

The enemies fought hand-to-hand combat for five hours. Each mound was its own battlefield, and whoever held the high ground claimed victory.

By 8 p.m., hundreds of Union and Confederate soldiers lay dead. The rest were tired. Whiting and Lamb had been wounded leaving Maj. James Reilly in charge.

Then a band of black Union infantry came in, prolonging the battle two more hours until Reilly waved a white handkerchief from Battery Buchanan.

A month later, Wilmington fell.

Then on April 9, 1865, Gen. Robert E. Lee surrendered to Gen. Ulysses S. Grant at Appomattox.

Union troops occupied Fort Fisher after the battle. Hunters and fishermen slowly took their place after the war.

The intricate underground network of shelters and tunnels burned or collapsed.

The palisade fence fell to the forces of wind and water.

And the ocean claimed more than half of the fort and its grounds.

What stands today is all that's left to tell the story of "The Last Major Stronghold of the Confederacy."

Rebel With A Cause.

By Sarah Friday Peters

If Gehrig Spencer played Jeopardy and the category "Fort Fisher" flashed on the screen, his fellow contestants would be in trouble.

Spencer, Fort Fisher's historic site manager, knows more about the last fort to fall in the Civil War than anyone.

Volumes of North Carolina Civil War history line his office shelves. Notes, records, photos, letters and diaries fill his file cabinets. And he's stored hundreds of conversations and articles in his "gray matter," as he likes to say.

Now Spencer hopes the records will not be all that's left of the fort's history.

And he's not playing games with its future.

"There's no place quite like Fort Fisher," Spencer says.

Painstaking research and reconstruction have taken place to make the fort as authentic as possible and to help people understand what happened here, he says.

Gehrig Spencer

"To lose the physical evidence of Fort Fisher would be a tremendous loss," he adds.

To look at the big piles of sand and mud covered with grass and a few trees, it's hard to see why.

But to talk to Spencer and walk the grounds, the concern becomes real.

Since the state historic site opened in 1965, Spencer has delved into the fort's past like a rebel with a cause.

He knows the history back and forth now, and can quote passages from letters and diaries verbatim.

"There's no place quite like Fort Fisher," Spencer says.

You soon believe he must have been there, too.

Spencer's intrigue comes from growing up in nearby Brunswick County.

Most of the troops came from that county, as well as others in the area such as Bladen, Columbus and Cumberland counties.

When Fort Fisher's construction began, most of the troops were young, Spencer says. But by the end of the war, junior and senior reserves protected the fort.

"They worked half a day, drilled half a day and walked guard duty at night," he adds. If they took leave, they went to Wilmington. They formed a garrison band, sang, played cards, sailed and looked forward to "boxes" from home.

Like other Civil War troops, they ate salt pork, biscuits and cornbread. One letter mentions collards. "In this area," Spencer says, "they had seafood delicacies as I would call it . . . fish and oysters."

Troops slept in basic barracks on the flat land behind the fort. A telegraph station was set up in one of the mounds; a hospital in another.

No doubt, the fort and its men were strong.

"We will be rite hard to whip," wrote J.A. McNeil, a soldier from Robeson County. "We works nine hours (through) hot day. . . . .Compared with what we has to put up with still we has som fun. . . .We has a heap a satisfaction a getting letters on one thing or another."

And now Gehrig Spencer gets a heap of satisfaction reading them.

The Back Page

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Some professional football players love to play on it; others despise it.

But no matter how players in the National Football League view AstroTurf, bay scallops in North Carolina find it a great place to settle.

That's one of the findings of a Sea Grant research team assembled to study bay scallop aquaculture and natural populations.

To collect spat for laboratory experiments and aquaculture grow-out, scientists Pete Peterson of the University of North Carolina Institute of Marine Science and Will Ambrose of East Carolina University tested several collection materials. They found that the young scallops settled most abundantly on suspended pieces of AstroTurf.

Collection methods are important because resource managers could use them to increase natural populations and shellfish aquaculturalists could use them as a source of stock.

The North Carolina General Assembly funded the study because the 1987 red tide devastated bay scallop populations, killing 98 percent of the young scallops. The study is designed to determine how natural populations can be increased and whether bay scallops are good candidates for aquaculture.

In laboratory experiments, Peterson was able to spawn bay scallops and raise them to adulthood. But Peterson says the scallops are more finicky than their cousins, the hard clams.

Sea Grant agent Skip Kemp agrees. He worked with a Pender County clam culturist to raise a small crop of scallops.

"Scallops are much more delicate," Kemp says. "They don't like silt, and they have to have a constant supply of food and water."

Last year, the scallops were raised in onshore upwellers. This year, Peterson plans to experiment with placing the young spat into nearshore submerged cages.

Meanwhile, Ambrose will be determining exactly who the bay scallops' predators are and when they are most voracious. And NCSU economist Jim Easley will calculate whether scallop aquaculture is profitable.

For demonstration purposes, Kemp will build a portable laboratory to show prospective aquaculturists the hatchery and nursery phase of scallop grow-out.

By now you've probably heard that the fish and chicken available at most fast-food restaurants isn't all that good for you.

And it's probably true.

A recent report from the Massachusetts Medical Society, published in *The New England Journal of Medicine*, claimed that health-conscious diners were being fooled at fast-food counters.

The report says that a fast-food chicken sandwich can contain as much fat as 1½ pints of ice cream. A fish sandwich is probably just as bad.

But the news is no reason to avoid seafood at home, says Sea Grant seafood education specialist Joyce Taylor.

After all, it's what you do to the fish in the preparation that makes it less than nutritious.

In its natural state, seafood is low in fat, calories and cholesterol and high in protein and minerals.

But sprinkled with salt, dipped in batter, fried in deep fat, seafood loses its edge.

"I meet a lot of people who tell me they're on a diet, so they eat a lot of fish. When I ask them how they prepare it, they say they roll it in cornmeal and fry it up. Now that's not a low-calorie food," Taylor says.

With the drop of a fish into the deep fat, you can add as much as 12 percent more fat to the fish, Taylor says. And the extra fat means more calories and cholesterol.

Instead of deep-frying or pan-frying, Taylor recommends poaching, steaming, baking, broiling, barbecuing, stir-frying or oven-frying.

And instead of topping fish with a cream or butter sauce, try herbs and spices. They won't disturb the delicate taste of the seafood.

As alternatives to salt, Taylor uses herbs and spices and white table wine as a broth.

Taylor's message is. . . If you prepare seafood properly, you can eat it to your heart's content.

For more information on seafood, contact Taylor at the NCSU Seafood Laboratory, P.O. Box 1137, Morehead City, N.C. 28557.

Happy Anniversary to Fort Fisher! Jan. 13 and 14, the famous fort will celebrate 125 years of history. A commemorative program will include tours of the grounds and historic interpreters recounting the days of battle at the fort. A special night program will feature a re-enactment of Maj. Gen. James Reilly's surrender to Union forces at Battery Buchanan.

For more information, write the Fort Fisher State Historic Site at P.O. Box 68, Kure Beach, N.C. 28449. Or call 919/458-5538.

Teachers, it's now available in video.

The instructional program, *North Carolina Coastal Plain: A Geologic and Environmental Perspective,* has been made into a video. This educational program was originally published as a filmstrip for use in 8th-grade science classes.

The video uses the coastal plain to explain geological, ecological and environmental science concepts. It runs 1¾ hours long and is divided into eight segments that range from 8½ to 17 minutes long.

With the video, teachers get an activity

continued next page

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guide that provides hands-on activities and a script with supplementary information for teacher and student use.

The coastal plain video was developed as a cooperative project between the N.C. Department of Public Instruction and Texasgulf Chemicals Co. It is available from Sea Grant. Ask for UNC-SG-89-02. The cost is $30.

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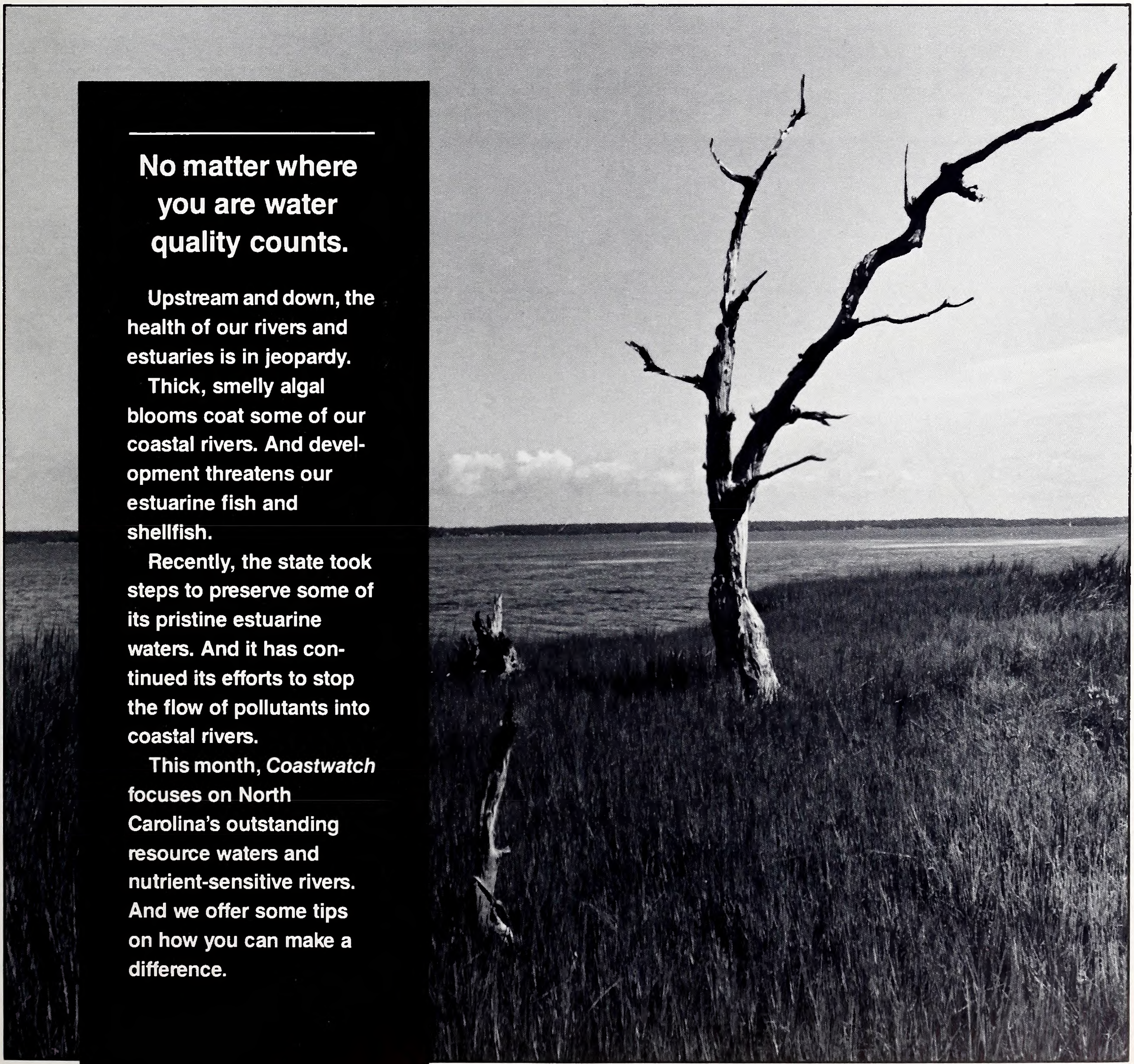


Photo by Jim Strickland

No matter where you are water quality counts.

Upstream and down, the health of our rivers and estuaries is in jeopardy.

Thick, smelly algal blooms coat some of our coastal rivers. And development threatens our estuarine fish and shellfish.

Recently, the state took steps to preserve some of its pristine estuarine waters. And it has continued its efforts to stop the flow of pollutants into coastal rivers.

This month, *Coastwatch* focuses on North Carolina's outstanding resource waters and nutrient-sensitive rivers. And we offer some tips on how you can make a difference.

Pristine and Protected

By Sarah Friday Peters

The best just got better in North Carolina.

On Sept. 14, the N.C. Environmental Management Commission designated almost 200,000 acres of coastal rivers and lakes as "outstanding resource waters."

Now seven water bodies from the Alligator River to Masonboro Sound carry extra protections against degradation.

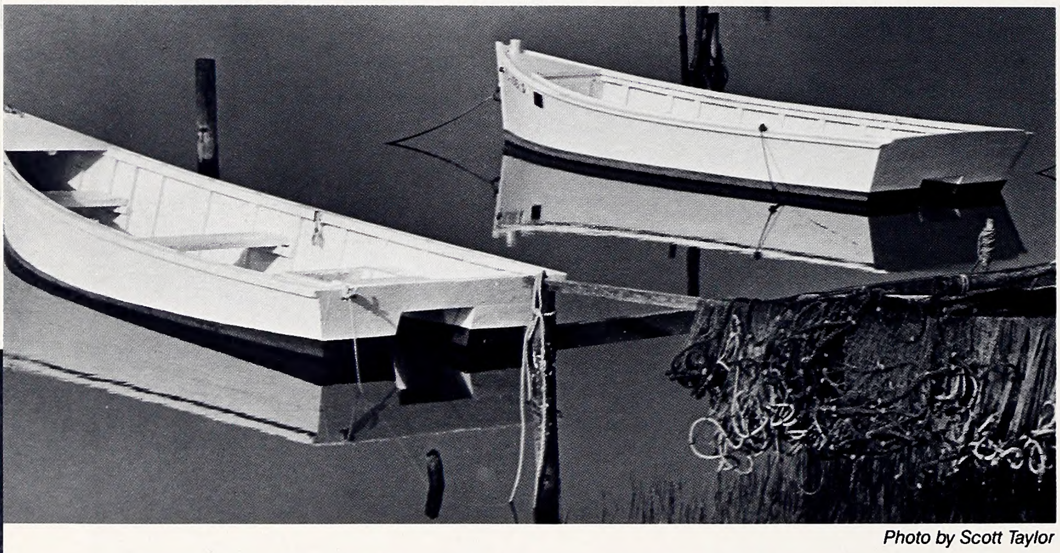


Photo by Scott Taylor

Like a principal honoring her best students with scholarships, the state chose its most pristine coastal waters and placed more stringent water quality standards on them.

From the public to the U.S. Congress, the move has garnered praise as an aggressive program to protect coastal resources.

But some scientists and environmental groups say it's not enough.

North Carolina's coast boasts approximately 2,044,374 acres of saltwater estuaries and sounds. Of that, 181,000 acres, or about 9 percent, were nominated as ORWs. Carteret County's Core Sound and the Alligator River in the Albemarle region make up 85 percent of that.

Fisherman Murray Bridges works Alligator River, its surrounding sound and the ocean for a living.

In the winter, he catches perch and flounder in the river's black waters. Other times, he pulls in mullet, croaker, gray trout, catfish, whitefish and blue crabs.

So far, Bridges hasn't seen too much pollution in the area but he isn't a scientist, he says.

Still, scientists agree with Bridges.

The Alligator River is surrounded by forests and farmland. No known sources of pollution seep into it. The water is dark, organically rich and has a low pH.

Fisheries resources thrive. Vegetation such as widgeon grass and wild celery covers the lower third of the riverbed. Black bear, red fox and even alligators roam its borders.

Like every water body in North Carolina, the Alligator River is classified by how it's used. Each classification also specifies the maximum amount of pollutants the water can handle before there's damage, says Derb Carter, an attorney with the Southern Environmental Law Center.

At the coast, SA waters, for example, protect shellfishing and demand the toughest water quality standards. SB waters, designated for recreation and fisheries, accept some sewage, bacteria and other pollutants. SC waters are safe for fishing and swimming but have a higher risk of pollution than SB waters.

The federal Clean Water Act in 1972 recommended states take a step beyond such measures and protect unspoiled rivers, lakes and sounds.

By 1986, North Carolina began its ORW program inland in places such as the South Toe River in Yancey County and the Cataloochee River in Haywood County.

The push for coastal ORWs began a year later with a petition to the EMC, a 17-member environmental commission that adopts regulations for controlling pollution.

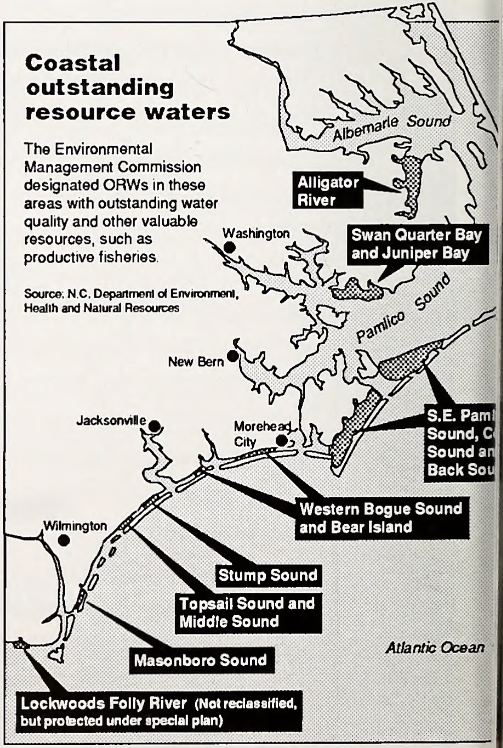
Industry waste, failing septic tanks, construction, mining, and stormwater runoff from development, farms and forestry foul some coastal waters.

But to qualify as an ORW, each site must show no known sources of pollution and carry a water quality rating of excellent.

In addition, it must have resources or uses that make it unique such as recreational use, outstanding fishing habitat or special ecological significance.

To find such waters, state and federal agencies tested coastal water chemistry and fecal coliform levels, and reviewed fish and shellfish resource data, seagrass bed information, land-use plans and permit actions.

By Sept. 1988, they had culled the best. Eight ORWs were nominated and ac-



Coastal outstanding resource waters

The Environmental Management Commission designated ORWs in these areas with outstanding water quality and other valuable resources, such as productive fisheries.

Source: N.C. Department of Environment, Health and Natural Resources

Albemarle Sound
Alligator River
Washington
Swan Quarter Bay and Juniper Bay
Pamlico Sound
New Bern
Jacksonville
Morehead City
S.E. Pam
Sound, C
Sound an
Back Sou
Western Bogue Sound and Bear Island
Wilmington
Stump Sound
Topsail Sound and Middle Sound
Atlantic Ocean
Masonboro Sound
Lockwoods Folly River (Not reclassified, but protected under special plan)

Graphic courtesy of The News & Observer

Photo by Jim Strickland

cepted for public hearing and further study by the EMC.

From north to south, the sites included Alligator River; Swan Quarter Bay and Juniper Bay; southeastern Pamlico Sound, Core Sound and Back Sound; western Bogue Sound and Bear Island; Stump Sound; Topsail Sound and Middle Sound; Masonboro Island; and Lockwoods Folly River.

From the beginning, public support favored coastal ORWs, says Charles Peterson, a member of the EMC and a Sea Grant scientist. Calls, letters and comments represented a growing public awareness of what's happening at the coast and the desire to save it, he adds.

In December, Gov. James G. Martin and his administration recommended ORW approval for the sites. The governor's backing "greased the skids," as one EMC member put it.

Even so, environmentalists were worried that the tide would turn.

Three EMC decision-makers held strong ties to development. And nine of the voting members were sworn in Sept. 14, the day the vote was taken.

There was some disagreement and discussion, Peterson says, but when the votes came in, none were even close.

All but one site was approved. Lockwoods Folly, one of the state's prime shellfishing grounds, had been closed because of pollution. EMC recommended a plan to clean up the waters. And they designated the Tar-Pamlico River as "nutrient-sensitive waters." (See story, next page.)

The EMC clearly saw threats to coastal waters with the rate and type of development occurring, Derb Carter says. By protecting existing water quality and refusing to tolerate degradation, "they acted in the best interest of all the citizens of the state who use and are interested in these waters," he adds. "They did the right thing."

The new ORW classifications protect critical areas such as shellfish beds, grass beds and nursery areas for young fish.

"Each water body has its own specific standards," Carter adds. "Each is different according to what resource you're trying to protect."

Basically the standards cover sewage disposal, density of development, new marinas, dredging and channels.

The biggest change is an expanded area where construction and sewage disposal permits will be required, Carter says.

Until now, specially designated waters have been protected by regulating development and discharges within a zone 75 feet back from the water.

For ORWs, the zone was expanded to 575 feet. And only low-density development is permitted within the zone. Twenty-five percent of an area can be built up.

No doubt those who watch the coast are pleased. In fact, the U.S. Congress is looking at using North Carolina's ORW classifications as a model for the rest of the country.

But some say it's just a start.

For one, the state's ORW plan may not provide the long-term protection that's needed, says Doug Rader, senior scientist with the N.C. Environmental Defense Fund.

Rader and other environmentalists say that while the new management plans differ with each ORW site, they are not specific enough in some areas.

For example, standards in shellfishing grounds such as Bogue and Stump sounds are not stringent enough to fully protect the resource, Peterson says.

And in regard to coastal development around ORWs, 25 percent density may be too much, says Todd Miller, executive director of the N.C. Coastal Federation.

The Federation recommended levels of 12 to 15 percent development to the EMC. Pine Knoll Shores, developed at 17 percent, is already experiencing water quality problems from stormwater runoff in its canals.

Others agree that the decision-makers need to expand the range of protection of coastal waters.

The new ORW plan focused on the most threatened waters along the southern coast. Identify and protect ORWs from Cape Lookout north now, Miller suggests.

Address the whole watershed and protect wetlands too, he says. What happens upstream affects the water downstream.

"North Carolina has a lot of waters in pretty good shape," Rader says. "With ORWs, we're trying to keep them that way," he adds. "We're the stewards."

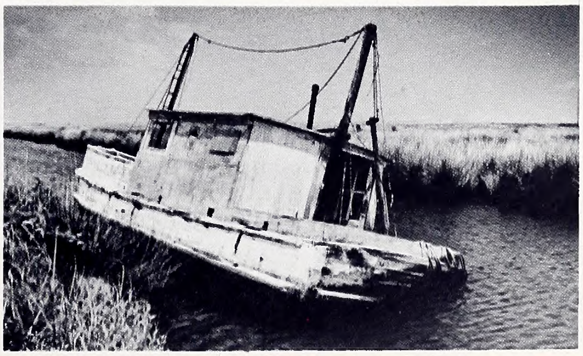


Photo by John R. Rottet

Prescription for the Pamlico

By Kathy Hart

The Tar-Pamlico is a river in trouble.

Fewer and fewer schools of spot and croaker fill fishermen's nets.

Slicks of dead fish and algal blooms occasionally foul the waters.

And ugly sores afflict crabs and fish with sickening frequency.

Etles Henries Jr. put it like this at a public hearing in June: "I think maybe people would understand a little better if they could ride down and see fish swimming around with holes in them, crabs eat up, just general terrible bad water—water bad enough that you don't want to get in it."

"The river is yelling and screaming for help," says Doug Rader, a senior scientist with the N.C. Environmental Defense Fund. "There is nothing else the river can do."

Like other rivers nationwide and in coastal North Carolina, the Tar-Pamlico is showing the symptoms of human abuse.

The ailment is a condition called eutrophication, a scientific term that means the river has too many nutrients, namely nitrogen and phosphorus.

What causes the ailment? You and me.

It's the output from our waste treatment plants and industries; the runoff from our farms, forests, backyards and city streets; and the acid-laden rain from the sky.

As a result of this ailment, the N.C. Environmental Management Commission recently classified the Tar-Pamlico "nutrient-sensitive" from the headwaters of the Tar River to a line in the Pamlico River connecting Roos Point and Persimmon Tree Point.

The Tar-Pamlico joins the Chowan, Neuse and upper Cape Fear rivers in sharing this nutrient-sensitive designation. Like the Tar-Pamlico, these rivers are rich in nutrients and plagued by algal blooms.

By designating a river nutrient-sensitive, the EMC places restrictions on nutrient input.

Now, nutrients are flowing into the Tar-Pamlico like water from a faucet. Scientists at the N.C. Division of Environmental Management calculate phosphorus levels at Tarboro average 0.15 milligrams per liter; nitrogen levels, 0.85 milligrams per liter.

These figures compare similarly to the Chowan River in the late 1970s and early 1980s when thick, malodorous blue-green algal blooms were as much a part of the Albemarle summer as watermelon and mosquitoes. Then, phosphorus levels in the Chowan measured 0.12 milligrams per liter; nitrogen, 0.96 milligrams per liter.

A 1988 study indicates that most of the nitrogen in the Tar-Pamlico comes from indirect sources management officials call nonpoint sources. These include 30 percent from farm runoff, 21 percent from forest runoff and 19 from acid rain. Another 15 percent of the total nitrogen comes from the pipes of waste treatment plants that discharge into the river.

In contrast, phosphorus flows mainly from point sources. About 50 percent comes directly from the pipes of Texasgulf Inc. in Aurora and 14 percent from waste treatment plants. Another 12 percent washes off farmland.

Two recent events will change phosphorus inputs. A phosphate detergent ban, enacted in 1987, has already reduced phosphorus by 8 percent. And a new discharge permit issued to Texasgulf Inc. will reduce the phosphate company's input by 90 percent by July 1, 1992. Then Texasgulf's overall phosphorus contribution to the Tar-Pamlico will drop from 50 percent to 9 percent.

An abundance of nutrients can trigger a chain of events that begins with an increase in the growth of single-celled organisms, such as algae and dinoflagellates, and culminates in low dissolved oxygen levels and fish kills.

It works like this.

Nitrogen and phosphorus spur nuisance algae and dinoflagellates to grow and multiply. In some rivers, such as the Neuse and Chowan, blue-green algae form "surface scum so thick you can almost walk on it," says Hans Paerl, a Sea Grant scientist who has studied algal blooms.

In other incidences, the algae and dinoflagellates spread densely through the first foot or two of surface water. There, they photosynthesize, adding lots of oxygen to surface waters.

But the algae block the penetration of sunlight and slow photosynthesis by plants deeper in the water column. If these plants can't photosynthesize, they don't produce oxygen. The water can become anoxic, or oxygenless.

That's when you find fish floating belly up.

But there are other causes for anoxia.

Photo by Kathy Hart

Photo by Steve Murray

Sea Grant researcher Don Stanley says decomposition of dying algae and dinoflagellates along the river bottom can rob waters of needed oxygen.

Couple the decomposition with no turbulence from wind and wave action to mix oxygen-rich surface waters with oxygen-poor bottom waters and waters can again become anoxic, Stanley says.

But oxygen depletion isn't the only problem. Nuisance algae and dinoflagellates aren't considered "tasty" by some fish and shellfish. This taste discrepancy can alter the food chain, leaving waters inhabited by less desirable bottom fish. And the algae and dinoflagellates can release toxins that can kill fish and shellfish.

And those are just the problems caused by algal blooms. An abundance of nutrients and poor water quality have also been connected to fish and shellfish diseases.

Sea Grant scientist Ed Noga has determined that ulcerative mycosis, a fish disease that infects menhaden and other fish, is directly linked to the stresses caused in the fish by poor water quality and nutrients.

Since nutrients are clearly the "germs" causing the Tar-Pamlico's ailment, the EMC placed restrictions on their input. Phosphorus inputs into the basin are to be decreased 64 percent. Most of the decrease will come when Texasgulf Inc. lowers its input in 1992. Meanwhile, the EMC required that nitrogen inputs drop by 10 percent.

The DEM will work with industries and waste treatment plants through discharge permits to decrease nutrient output from these sources. And farmers will be encouraged through the N.C. Agricultural Cost Share Program to implement Best Management Practices in their barnyards and fields. The BMPs include contour plowing, terraces, crop rotation, grassed waterways and animal waste management.

Although the nutrient-sensitive designation is a step in the right direction for the Tar-Pamlico, Rader feels the restrictions were not tough enough.

"The state is waiting for results from the Albemarle-Pamlico Estuarine Study to implement tougher restrictions," Rader says. "But I'm not sure the river can wait for science. Virginia officials are planning to reduce nitrogen and phosphorus levels in the Chesapeake by 40 percent using seat-of-the-pants science. That's the kind of thing I believe we need to do on the Pamlico."

And Rader is concerned about nitrogen input from acid rain. "EPA (Environmental Protection Agency) estimates that by 2030, emission of nitrogen (from combustion engines in cars and trucks) into the air will go up 60 percent in the Southeast," he says. "If so, that will be a big change, and the state needs to address that."

As "doctors" to the ailing rivers, scientists such as Paerl, Stanley and Noga are beginning to diagnose the symptoms and offer resource managers some remedies. And they're broadening their examinations to include the estuarine systems downstream.

All of North Carolina's nutrient-sensitive rivers empty into vital, productive estuaries that serve as nurseries to 90 percent of the state's commercially important species of fish and shellfish. And in that flow of water teems plenty of nutrients that are just beginning to cause estuarine maladies.

Paerl says he is seeing more salt-tolerant algal blooms in estuaries. And the input of nitrogen from acid rain may have an even greater impact in estuaries and nearshore waters than it does in our rivers, he says.

But the prognosis is not all bad.

"With good science and proper management, the nutrient problem can be reversed," Paerl says. "But we have to start now. The environment can't absorb any more than we're putting in it presently."

Photo by Allen Weiss

Good, Clean Advice

By Sarah Friday Peters

Take a quick tour through your home and yard.

Pass by the driveway and walkways; walk through your grass and by your plants.

Inside, check out your kitchen and your bathrooms. Even look in the laundry room.

What you see could spell trouble for North Carolina's coastal waters.

Fertilizers, leaking toilets, runoff from driveways, leftover paint and motor oil are just a few of the culprits.

Every time we wash our hands, clean our dishes or water our lawns, we add to the load of wastes and heavy sediments flowing to the coast.

Federal, state and local laws protect the waters and their uses. But with a few helpful hints, you can do your part to conserve and preserve this vital coastal resource.

Around Your Yard

Loose soil and poor drainage can facilitate erosion, flooding and runoff. To reduce surface runoff:

- Plant ground cover, shrubs and trees to promote infiltration.
- Landscape with plants appropriate to your soil. Don't select plants that need lots of watering.
- Divert rain from paved surfaces onto grass to permit gradual absorption.
- Encourage your community to minimize the use of asphalt.

Lawn and Garden

About 20 million acres of lawn exist in the United States. If healthy, a lawn can help prevent erosion and act as a filter for rainwater. If fertilizers or pesticides are used recklessly, lawns and gardens can be a source of pollution.

For a healthy lawn:

- Plant the right type of grass for your location.
- Don't overwater your lawn.
- Use the right fertilizer for your soil at the right time. Do not apply it on windy days or just before it rains.

Inside Your Home

Many of the products we use at home pose no threat to the environment when they're properly disposed of and treated. But some of the most common products such as floor wax and furniture polish are toxic to people and the environment.

Take care to:

- Read labels. Know what chemicals are potentially hazardous. A few are lye, phenols and petroleum distillates.
- Use alternative, less harmful products whenever possible. For example, lemon oil mixed with linseed oil makes a good furniture polish.
- Recycle motor oil and antifreeze.
- Never put the most toxic household products into sewer or septic systems. Take leftovers to a landfill or your town's hazardous waste collection site.
- Make sure your community has effective sewage treatment.

Water Conservation

Most of us use about 100 gallons of water a day, when we need only four. Conserving water helps at the coast, but it can also mean lower sewer, energy and water bills. To save water:

- Check your water meter while no water is being used. If the dial moves, you have a leak. Fix any that you find.
- Turn off your water and water heater when you go on a trip.
- Run dishwashers and washing machines only with a full load.
- Don't keep the water running when you wash dishes in the sink, brush your teeth or shave.
- Install a water conservation shower head.
- Take short showers instead of a bath.
- Wash your car and water your lawn only when necessary.

These tips are taken from *Sound Advice*, a guidebook published by the N.C. Coastal Federation and WRAL-TV. For a copy, send $3 to the N.C. Coastal Federation, 3223-4 Highway 58, Swansboro, N.C. 28584.

Photo by Rex Gary Schmidt

The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

In the rubble left by Hurricane Hugo are some valuable lessons about coastal construction, says Sea Grant coastal engineer Spencer Rogers. He surveyed the damage along the South Carolina coast after the Sept. 21 hurricane.

"There were no surprises," Rogers says. "The buildings that fell were poorly suited for the conditions that occurred."

The homes and businesses that collapsed were built on concrete slabs or pilings that extended only a few feet into the sandy soil, Rogers says. During the hurricane, the waves and storm surge washed the sand from around the shallow foundations and caused the buildings to fall.

Other buildings sustained heavy wind damage because they did not use straps to connect floors, walls and ceilings.

"You have to tie a building together from the peak of the roof to the bottom of the foundation with good, solid connections to resist the winds," Rogers says.

"In areas subject to erosion and flooding, you have to elevate the building above the water because everything the waves hit they usually destroy."

Rogers says total building destruction was the exception rather than the rule on the Sandlapper coastline.

"Many buildings are beat up and bruised," he says. "But most are repairable and reusable."

How would North Carolina have fared if Hugo had whirled ashore along our coastline?

Much better, Rogers says.

The N.C. Building Code requires pilings in erosion-prone areas to extend 16 feet below the soil surface. And hurricane clips are a must.

"Any area hit by a storm of that magnitude would be beat up, and some buildings would totally collapse," he says. "Our standards and quality are by no means perfect, but the damage would have been a lot less in North Carolina."

Cracking into shellfish aquaculture can be a tough task. But fishermen and entrepreneurs can break into the business by coming to a one-day conference Feb. 17 at the Duke University Marine Laboratory on Pivers Island.

The morning session of the third annual Shellfish Culture Conference will address North Carolina's permitting and leasing programs. State agency representatives will be on hand to talk about the system, its history and how to apply for a permit or lease. A N.C. aquaculturist will follow to lead discussion on the pros and cons of the system.

In the afternoon, East Coast experts will give up-to-date technical advice on successful scallop culture.

The workshop is co-sponsored by state fisheries organizations and agencies. For more information, call Sea Grant agent Bob Hines at 919/247-4007.

Neither rain nor sleet can stop the U.S. Postal Service. And even a hurricane couldn't stop volunteers for The Big Sweep '89. Hurricane Hugo blew his mighty forces across the Carolinas Sept. 23, delaying North Carolina's cleanup one week.

But on Sept. 30, more than 3,645 people came to the coast, inland parks and rivers for the state's first waterway cleanup.

They covered Duck, Emerald Isle, Wrightsville Beach, the Tar River, Lake Jordan, Lake Lure and 49 locations in between. And they picked up enough trash to fill approximately 5,252 bags.

Out of 25 states holding cleanups this year, North Carolina ranked fourth in the number of volunteers and amount of trash collected. Puerto Rico, the Virgin Islands, Canada and Mexico also held beach cleanups.

UNC Sea Grant is compiling the number of items collected during The Big Sweep, and final tallies will be reported soon. A few of the more unusual items volunteers found included lawn chairs, car headlights, coconuts, a toilet seat and a computer chip.

And some of this year's booty had a foreign look. Folks found a bottle of German detergent, hair mousse from Colombia, hair spray from the Soviet Union and a jar of salmon eggs from Siberia.

Keep an eye on *Coastwatch* for the final results and information on The Big Sweep '90, set for Sept. 22.

For every pound of shrimp North Carolina fishermen catch, another four to 13 pounds of finfish may be swimming in their nets. For shrimpers, the extra bulk doesn't pay off. And sportsfishermen are worried the bycatch reduces stocks.

The problem has already become an issue in Florida where shrimpers have been banned from fishing in parts of Tampa Bay.

But fisheries experts in North Carolina hope to squelch the smoke before it becomes a fire.

That's why Sea Grant has initiated a project to find a new type of gear that can reduce shrimpers' bycatch.

With a new grant from the Southeast Regional Office of the National Marine Fisheries Service, two Sea Grant advisers, a netmaker and a scientist hope to help devise the perfect Finfish Separator Device for Tar Heel waters.

Experimental FSDs come in several different shapes and sizes now, but most are funnel-shaped with large-mesh net at the top. As the net is pulled, the shrimp whisk through the funnel as fish escape through the top.

This winter, Jim Murray and Jim Bahen of Sea Grant, netmaker Steve Parrish, and

Continued on next page

an advisory committee will identify 20 "highliners," or opinion leaders, in the fisheries.

With three drawings in hand, they'll ask the highliners which net would work best and how it could be improved.

After modifications are made, the team plans to test its FSD in a flume tank and then out on the water.

Roger Rulifson, a zoologist at East Carolina University, will video the field tests to find out how the fish react to the new nets. Then changes can be made based on their reactions.

"We do not see this as a panacea, but a start," Murray says. "We're trying to do some work—involve fishermen's ideas—before there's a crisis."

The Albemarle-Pamlico Estuarine Study is seeking proposals for its fourth funding period. The study gives grants for research and public involvement projects that will lead to an effective conservation management plan for the Albemarle-Pamlico region.

APES proposals can be submitted from Nov. 22 to Jan 12. Late proposals will not be considered.

For more information, write Robert E. Holman, DEHNR/Albemarle-Pamlico Estuarine Study, P.O. Box 27687, Raleigh, N.C. 27611.

If visions of Christmas are dancing in your head, why not give your friends and family the gift of better health.

No-Salt Seafood, written by Sea Grant seafood education specialist Joyce Taylor, offers seafood recipes that contain no added salt—only what occurs naturally in the food or in small quantities in the ingredients.

The American Heart Association recommends that everyone restrict salt consumption, especially those with high blood pressure. Salt may not cause high blood pressure, but it can make the condition worse.

To help everyone lessen their dependency on the salt shaker, Taylor and a group of food and nutrition leaders from Carteret County eliminated table salt from more than 40 seafood recipes. In its place, she substituted herbs, spices, citrus juices and table wines.

For a copy of *No-Salt Seafood*, write UNC Sea Grant. Ask for publication UNC-SG-89-07. The cost is $3.50.

After seven years of writing about science, seafood and fishermen, Nancy Davis left the *Coastwatch* staff in October to take a job with the University of North Carolina at Chapel Hill.

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Photo by Steve Murray

Launching Sea Grant into the 1990s

Back in the 1960s, ecology was in.

People held sit-ins, rallies and protests for the sake of clean air, pure water and wildlife protection.

But in the 1970s and 80s, the environment was almost forgotten.

Now it's a new decade. And the movement has come full circle.

At the coast, trashy beaches, rising sea level, dwindling fisheries and deteriorating water quality have revived our ecological conscience.

In the midst of renewed environmental interest, Sea Grant continues its 25-year tradition of promoting wise use and development of coastal resources.

And the work is more important than ever. Within this decade, it's predicted that 75 percent of the nation's population will live within 50 miles of the coast and Great Lakes.

Since North Carolina has 320 miles of coastline, it will experience its share of the problems. And North Carolina's Sea Grant Program will be there with some of the answers.

During the next two years, Sea Grant scientists will be solving water quality problems, developing new seafood products, discovering why fish stocks fluctuate and building aquaculture into a successful enterprise.

And in their usual manner, Sea Grant's 11 extension agents will relay the researchers' findings back to you.

In this issue, *Coastwatch* will introduce you to 18 new Sea Grant research projects.

Estuaries

Talk about North Carolina's estuaries these days seems always to come around to one topic: water quality.

People are concerned that the rapid development of our coastal plain is taking its toll on the quality of its waters.

Sea Grant is worried, too. That's why the program is sponsoring five new projects that delve into problems facing our estuaries.

To recreational fishermen, North Carolina's coast is a paradise. The state's temperate waters host fun-seeking fishermen year round. And no one denies the economic benefits to coastal residents.

But poor water quality in the state's estuaries may be causing a decline in the number and quality of fish landed by these die-hard anglers. And the end result may be that fewer fishermen frequent the coast.

North Carolina State University economists Kerry Smith and Raymond Palmquist will determine what recreational and economic benefits would accrue in coastal communities from improved water quality.

The results of this study could provide further impetus for coastal managers to clean up our coastal shores.

It's a fact in eastern North Carolina. If you farm soppy coastal plain soils, you have to drain and ditch them.

And where there are farms there are fertilizers. And that spells potential for a massive influx of nutrients—nitrogen and phosphorus—down the ditches and into our coastal watersheds.

Already coastal rivers are experiencing nutrient-spurred algal blooms and other water quality problems.

At least a partial answer to some of these problems may be back on the farm.

In a new Sea Grant project, NCSU scientists Wendell Gilliam, Wayne Skaggs, Robert Evans and John Parsons will examine ways to lessen the flow of nutrients from farmland into coastal waters.

The team has developed methods already in use by farmers to control drainage and lessen nutrient input. In fact, they estimate that 150,000 acres of controlled-drainage farmland in North Carolina is reducing nitrogen outflows by 1 million pounds annually.

With their new project, the NCSU team plans to develop other land-based methods for decreasing water quality problems.

John Wells and Larry Benninger, two University of North Carolina at Chapel Hill geologists, will be digging deep for some answers to water quality problems in Pamlico Sound.

The pair plans to sift and core the sediments of the sound to learn more about the relationship between water quality and the estuary bottom.

Wells and Benninger believe sediments may play a role in storing heavy metals, pesticides and other toxic substances.

This may be particularly important in North Carolina's sounds where the barrier islands trap sediments and allow only limited movement of sediments offshore.

Don Stanley and Joseph Boyer of East Carolina University will determine how much is too much when it comes to nutrients in the water column.

Using huge tanks at the Rhode Island Marine Ecosystem Laboratory to imitate conditions found in North Carolina estuaries, the duo will quantify the relationship between nutrients and algal growth. And they will use the tanks to determine how plants and animals recycle nutrients and how nutrients cause algal blooms.

Seagrasses are the staff of life in North Carolina estuaries. They play a critical role in the coastal food chain.

But they can also be susceptible to water quality problems. Sea Grant researchers JoAnn Burkholder and Larry Crowder of NCSU will decide how excessive nutrients in estuaries affect seagrass growth.

Botanist Burkholder will assess the effects of nutrient-caused algal growth on seagrasses. She believes the algal mats may stunt seagrass growth by blocking sunlight.

Portsmouth Island

Zoologist Crowder will monitor seagrass grazers (snails, fish, crabs and others) to determine whether they dine on the algae or the grass. This grazing may change how the grass responds to additional nutrients.

Fisheries

North Carolina's commercial fishermen are baffled.

Some years they pull up nets bulging with fish. Other times, the nets come up nearly clean.

The phenomenon has fisheries managers scratching their heads and scientists searching for answers.

Researchers John Miller and Len Pietrafesa from NCSU say the fluctuations may be linked to how young fish move from the ocean into the state's estuaries.

When adult fish spawn offshore, only a small percentage of their young survive. The small fish must migrate to protective estuaries to thrive.

Miller and Pietrafesa will study the pathway young fish take to enter the inlets and will learn how the ocean currents and sound circulation combine to affect a successful migration to nursery areas critical to their survival.

The size of larval and juvenile fish as they enter the estuaries may also affect their survival, say NCSU zoologists Jim Rice and Larry Crowder.

With computer models and field experiments, the team will determine how big young spot must be to sur-

Photo by Scott Taylor

Photo by Scott Taylor

vive predation and starvation before they enter the state's nursery grounds. Their findings will translate to other estuarine fish and lead to a better understanding of why fluctuations exist.

David Checkley, an NCSU oceanographer, is taking a closer look at the young fish that survive migration to find clues to the mystery.

By looking at protein layers in the ear bones of menhaden, Checkley can determine the fish's age and the water temperature at which it developed. Using satellite imagery, he can map where spawning took place.

Knowing conditions of early growth creates a better understanding of the conditions that help the larvae survive, Checkley says. And it may explain why populations vary year-to-year.

With his research, Checkley can look at the number of eggs spawned each year and help predict how many adult menhaden will survive. And because menhaden are similar biologically to other fish that roam the oceans, his findings can be applied to species around the world.

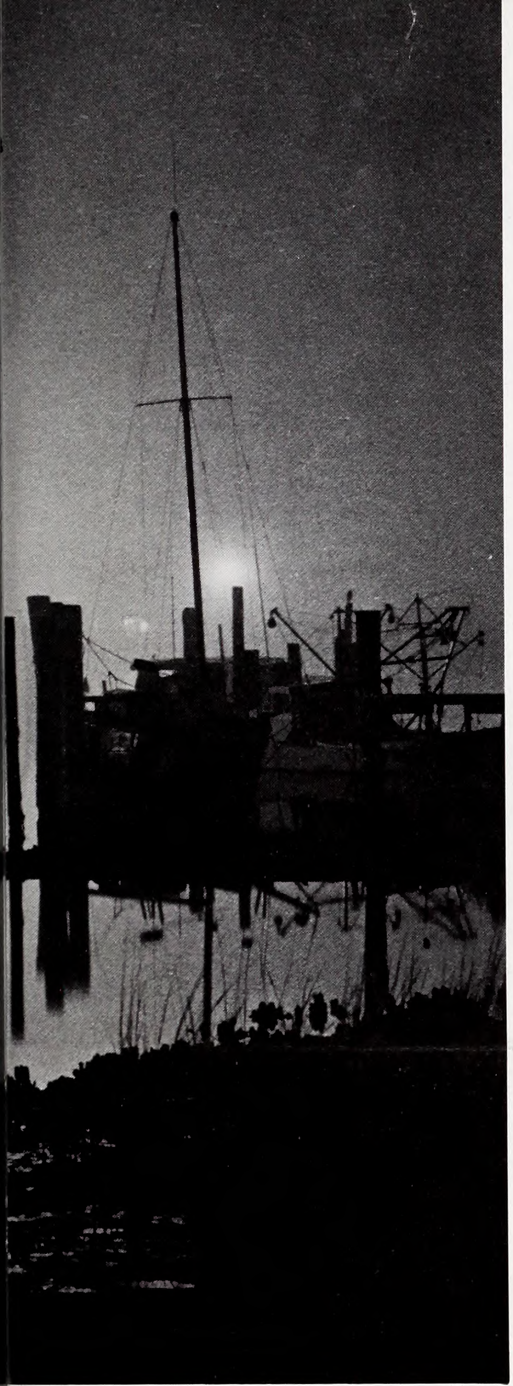
As Checkley looks to solve some questions about young menhaden, Ed Noga of the NCSU College of Veterinary Medicine will address a problem plaguing the old of the species.

Angry, open sores have been eating away at the flesh of menhaden and other fish in the Albemarle-Pamlico estuary. Noga diagnosed the culprit as a disease called ulcerative mycosis.

He links the cause of the disease to a bacteria found in the water. To learn more about the bacteria, Noga will develop a laboratory model of the disease. And he'll also look at how environmental changes, primarily water quality, affect its growth.

As NCSU scientists try to unravel some mysteries concerning traditional stocks, Charles Peterson of the UNC Institute of Marine Science will concentrate on a new stock—soft-shelled or steamer clams.

Seafood connoisseurs in the North-



Beaufort harbor

east are hungry for the sweet-tasting soft-shelled clams. But supplies of the savory shellfish, normally harvested from more northern waters, aren't abundant enough to meet the high demand.

But the sandy bottomland of Pamlico Sound may provide the perfect place for soft-shelled clams to grow.

Peterson plans to test the potential for a soft-shell clam aquaculture industry in North Carolina. He'll look at the clam's biology, its habitat and possible predators to determine the best conditions for a successful venture.

Aquaculture

The challenge of aquaculture is simple.

Americans are demanding more seafood, but the supply just doesn't meet the demand. To offset the difference, seafood processors and retailers import.

Aquaculture could be a viable way to meet demand in the United States and cut imports.

That's why people took notice when Beaufort County farmer Lee Brothers harvested his first hybrid striped bass for market.

It was the nation's first commercial harvest of pond-raised hybrid striped bass. It was also a significant step for Sea Grant researchers who have spent the past decade developing this type of aquaculture into a profitable venture.

But despite the success of Brothers' operation, the culture of hybrid striped bass is not yet an efficient enterprise, says Ron Hodson, Sea Grant's associate director. He identifies three problems in hybrid culture that Sea Grant scientists will attempt to tackle in 1990.

One problem concerns the production of broodstock. All eggs used in the Brothers operation are taken from wild fish. Hodson and NCSU zoologist Craig Sullivan are looking for ways to domesticate broodstock.

They will experiment with the use of hormones in maximizing egg production. Solving these concerns will give aquaculturists control over the life cycle of the hybrid, Hodson says.

And the NCSU duo will be investigating ways to increase survival of fingerlings in controlled environments. Decreasing the loss of fingerlings could solve another problem facing the aquaculture industry and add more fish to the final harvest.

Feed can be a costly problem for fish farmers. Because feed for hybrid striped bass is based on animal proteins (primarily fish meal), more than 50 percent of the cost of raising the hybrids can be spent on feed.

This year, Margie Gallagher of ECU will investigate less expensive ways of providing protein to hybrid striped bass in production.

At the same time, Joseph and Celia Bonaventura of the Duke University Marine Laboratory will explore ways to force-feed these fish in the larval stage.

Since these tiny fish don't feed well naturally in their early stages, the Bonaventuras will attempt to develop a process that allows the fish to absorb food molecules. This is, in effect, a force-feeding, Hodson says.

The primary focus of Sea Grant's aquaculture research will be to assure that the successes of the past are fine-tuned, making hybrid striped bass an important ingredient in America's expanding seafood market.

Seafood

During the 1980s, we dared to eat what we had never eaten before—sushi, shark, squid and surimi—and all in the name of good health.

Like oat bran, seafood was a healthy "in" in the 80s.

But seafood's meteoric rise in popularity left the food industry sometimes playing catch up as they rushed to develop new products and address health and safety concerns.

Four new UNC Sea Grant projects are designed to help the food industry solve some "fishy" problems.

NCSU seafood scientists Tyre Lanier, David Green, Roy Carawan and Brian Sheldon are examining ways to refine surimi, or minced fish, processing.

Presently, 30 percent of the protein contained in the raw fish is rinsed down the drain as the fish is repeatedly washed and minced during processing. But the NCSU seafood team would like to recover and concentrate that protein.

Such a process could reduce the amount of water used in processing. And the concentrated protein recovered from the wash water could be developed into a flavoring, used as a protein supplement for other food products or added back to the surimi to fortify its nutritional value.

In another surimi project, Lanier teams up with NCSU food scientist Don Hamann to explore the mixture of fish paste and red meat in processed products such as frankfurters, luncheon meats and sausage.

Alone, surimi possesses superior gelling and binding properties that seem to make it an excellent candidate for bologna and salami. But when fish and red meat are mixed and processed with techniques presently in use in the food industry, it lessens the surimi's gelling and binding properties.

Lanier and Hamann will try to determine what causes the change in the surimi and find a processing method that will allow the surimi to retain its ability to gel and bind.

Their research results may be valuable to food processing giants such as Oscar Meyer, General Foods and Gerber.

In a health and safety issue, Jim Oliver, a biologist at UNC-Charlotte, will study the effects of temperature on a novel, but deadly, pathogen called *Vibro vulnificus*. It is found in raw oysters, particularly those harvested from the Gulf of Mexico.

The pathogen can be fatal to people whose immune systems have been lowered by diseases such as AIDS, cancer or pneumonia. And there is special concern for pregnant women.

Oliver believes temperature may be a key factor in determining how infectious and how numerous these *Vibro* pathogens may be in raw oysters. He's especially concerned about the temperature fluctuations oysters sometimes undergo between harvest and consumption and how these fluctuations affect the pathogen's infectious ability.

Photo by Scott Taylor

Seafood market in Morehead City

Oliver's results could provide lifesaving information for doctors and health officials who have patients susceptible to the pathogen.

In another safety and health issue, ECU scientists David Griffith, Jeff Johnson and Margie Gallagher and Sea Grant Marine Advisory Service Director Jim Murray will explore how information about coastal pollution affects people's perceptions about seafood quality and safety.

While nutritionists are singing the health benefits of seafood, the media is reporting ever-increasing incidences of seafood contamination by industrial pollutants, medical wastes and biological toxins.

Consumers are confused.

In fact, North Carolina provided a prime example of that confusion during the red tide outbreak several years ago. The type of red tide present in our waters contained biological toxins that concentrated in shellfish and made them dangerous, but not fatal, to consumers. Fish, crabs and shrimp, however, were safe to eat.

Consumers frightened by what they heard and read swore off all North Carolina seafood. Seafood processors and retailers suffered, and the state had to mount an extensive media campaign to revive North Carolina's seafood industry.

If the seafood industry and state and federal officials had understood more about how the public perceived the outbreak's effect on seafood quality, they might have been able to head off the problems.

And that's exactly the kind of information this Sea Grant project will provide. The team will survey consumers to learn how they feel about coastal pollution, seafood safety and seafood inspection.

The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

Sea Grant is helping train tomorrow's scientists today. For the first time, UNC Sea Grant is sponsoring a program to promote graduate studies in marine-related fields. This year, 13 graduate students will work hand-in-hand with Sea Grant scientists on research projects. Such a liaison has three benefits, says Sea Grant Director B.J. Copeland.

First of all, one of the most effective ways to transfer technology from the university to people who can use it is through graduate students, Copeland says.

For example, a few years ago two North Carolina State University students worked with Tyre Lanier's ground-breaking development of a seafood substitute called surimi. Now those students work in the forefront of surimi production for a major U.S. food corporation.

Also, because Sea Grant takes an interdisciplinary approach to solving coastal issues, the graduate students will be trained to take a broader look at problems and create practical solutions.

Thirdly, enabling top students to work with Sea Grant scientists supports university research.

One of the graduate students will be working with civil engineers John Fisher and Margery Overton, who have been developing a technique to predict coastal dune erosion during storms. Using computer and laboratory simulations, the graduate student will test the engineers' model with data from 1989 hurricanes Hugo and Jerry.

North Carolina's estuaries are coastal gems. Their protection is vital to shellfishermen, anglers, property owners and a myriad of coastal flora and fauna.

Managing estuaries properly is a key to their survival. A new report about the Albemarle-Pamlico estuarine system spells out the status of the nation's second largest estuary and makes recommendations for managing it.

"This report documents all we know about the Albemarle-Pamlico system," says UNC Sea Grant Director B.J. Copeland, who organized the report for the state's Albemarle-Pamlico Estuarine Study office.

Copeland says the report provides information that will lead to proper development and management of the Albemarle-Pamlico system in North Carolina.

"We called on the best experts North Carolina had to offer for this project," Copeland says.

The report is available in its technical version and in a more readable summary at the library of the state's Department of Environment, Health and Natural Resources in the Archdale Building on North Salisbury Street in Raleigh.

Copies are available in libraries at North Carolina State University, East Carolina University, the University of North Carolina at Chapel Hill, College of the Albemarle in Elizabeth City and the Duke University Marine Laboratory on Pivers Island.

The National Sea Grant College Program office in Washington, D.C., has funded the UNC Sea Grant College Program for 1990.

UNC Sea Grant Director B.J. Copeland says the $1.19 million in federal funds and the $650,000 in matching state funds represent the same level of funding received by UNC Sea Grant in 1989.

The new funds guarantee continuation of the UNC Sea Grant's vital activities in coastal research, extension and education.

The National Marine Fisheries Service has produced a video that will teach recreational fishermen catch-and-release techniques.

Pass It On is a 28-minute video that educates fishermen about the importance of saving the catch for another day. It's part of a larger angler-ethics program in the Southeast designed to encourage anglers to practice fisheries conservation.

Sea Grant has a limited number of copies of the video. If you or your fishing club is interested in obtaining a copy, contact Jim Murray, Sea Grant's Marine Advisory Services director at 919/737-2454. Or write Murray at UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695.

Want to know more about shellfish culture? The most up-to-date information on growing scallops and other shellfish will be presented during a shellfish culture conference scheduled for February 17 at the Crystal Coast Civic Center in Morehead City.

The one-day event will be sponsored by UNC Sea Grant, the N.C. Fisheries Association, the UNC Institute of Marine Sciences and the N.C. Division of Marine Fisheries.

State Senator Marc Basnight of Manteo and a host of shellfish experts from up and down the East Coast will speak on leasing, permitting, current legislation and state-of-the-art scallop culture. Question and answer periods will follow each session.

The conference fee is $15 for pre-registration and $20 at the door. The fee includes lunch. For more information, contact Skip Kemp or Bob Hines at 919/247-4007.

Fishing for a New Catch premiered on the University of North Carolina Center for Public Television in July. Now the 30-minute documentary on underutilized species is available for loan or purchase from the Sea Grant office.

The video was produced by Sea Grant, the National Marine Fisheries Service and North Carolina State University's Department of Agricultural Communications. It's aimed at saltwater sportfishermen in the Southeast.

NMFS estimates that recreational fishermen discard as much as 60 percent of the fish they catch because they don't consider them table fare. *Fishing for a New Catch* introduces sportsmen to some of those less-favored fish and explains how to handle and clean them.

Sea Grant Marine Advisory Service Director Jim Murray recommends the video for sportfishing clubs. It's available for loan or for sale at $12. To reserve your copy, contact Murray at 919/737-2454.

The South Carolina Department of Parks, Recreation and tourism has produced a guide to the beaches in that state.

South Carolina Public Beach and Coastal Access Guide provides a comprehensive listing of public and commercial outdoor recreational areas along the coast. And it lists activities and facilities available in each coastal county.

For your copy of the 137-page book, send $3 to: Coastal Access Coordinator, Division of Engineering and Planning, S.C. Parks, Recreation and Tourism, 1205 Pendleton St., Columbia, S.C. 29201. Make checks payable to S.C.PRT.

You'll notice a new byline flying beneath the headlines of our *Coastwatch* stories.

It's that of Calvin Edgerton. He joined the Sea Grant communications staff in December, replacing Nancy Davis. Edgerton comes to Sea Grant from *The Smithfield Herald,* where he was Feature Page editor.

Edgerton is also an excellent photographer. He recently had two photographs published in *The Big Click,* a four-color coffee-table book that captures a day's events in North Carolina.

For Sarah Friday Peters there will be no more writing about erosion rates, fishing gear and trash cleanups. After five years with the Sea Grant communications staff, Peters is leaving to take a job with *The News and Observer.*

The Big Sweep is history but you still have a chance to own one of our first-quality all-cotton Big Sweep T-shirts.

Decorated with a catchy blue and yellow "Big Sweep '89" logo, these durable white shirts can hang in your closet for only $3 each. That's half of their original $6 price tag. To make it an even better deal, we'll send them postage paid.

The shirts come in small, medium, large and extra-large sizes and make great gifts. For your shirts, send check or money order to UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695.

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Coastwatch

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Coastwatch

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Photo by Scott Taylor

Everything in nature is related to everything else.

People are an integral part of the scheme of things. That's why it's important to understand the cycles of nature, the ebbs and flows of mechanisms that have repeated themselves for millions of years.

This month, *Coastwatch* takes a look at one of these processes—the annual winter migration of infant fish from the warm waters of the Gulf Stream into North Carolina's estuaries.

We examine the estuaries and explore how they work in the natural scheme. We also look at man's influence on this fragile coastal process.

Amazing Journey Into

By C.R. Edgerton

Under the cool night sky off Ocracoke Inlet, several fishermen keep a vigil, casting their lines again and again into the foamy surf.

Silhouetted by the moon's orange glow, they catch spot, croaker, flounder.

They've spent uncounted nights here, relishing the salt air in their lungs and the spray of surf in their faces. They figure they know all there is to know about fishing in Ocracoke Inlet.

But they don't.

Just beyond their heavily weighted lines, a mysterious process unfolds in the open sea.

A dynamic merging of water, wind and currents prompts the migration of millions of recently hatched fish from the warm waters of the Gulf Stream, through the inlet and into the calmer waters of Pamlico and Albemarle sounds.

Within this migration are the infant spot, flounder, croaker and other fish that one day might dangle at the end of an angler's line. Yet, most fishermen don't know the migration process or how important it is to life in the sea.

Nor do they realize that the numbers of fish in the sounds may be traced to this migration.

Sea Grant researcher John Miller, a North Carolina State University zoologist, calls the winter migration of infant fish one of the most important biological events on the East Coast.

"People need to be aware that a great many of the most important species in the estuaries don't spawn there," Miller says. "They spawn offshore and migrate into the sounds through a quite remarkable process."

Miller says the fish involved in this annual migration account for a significant slice of the state's fishing economy, with menhaden topping the list in volume. About 90 percent of the fish caught in the state belong in this group.

The fish are spawned and hatched in early winter in the Gulf Stream and spend the next 60 days crossing the waters of the continental shelf. Currents toss them toward the Outer Banks with a fury, sometimes carrying the quarter-inch creatures four miles a day.

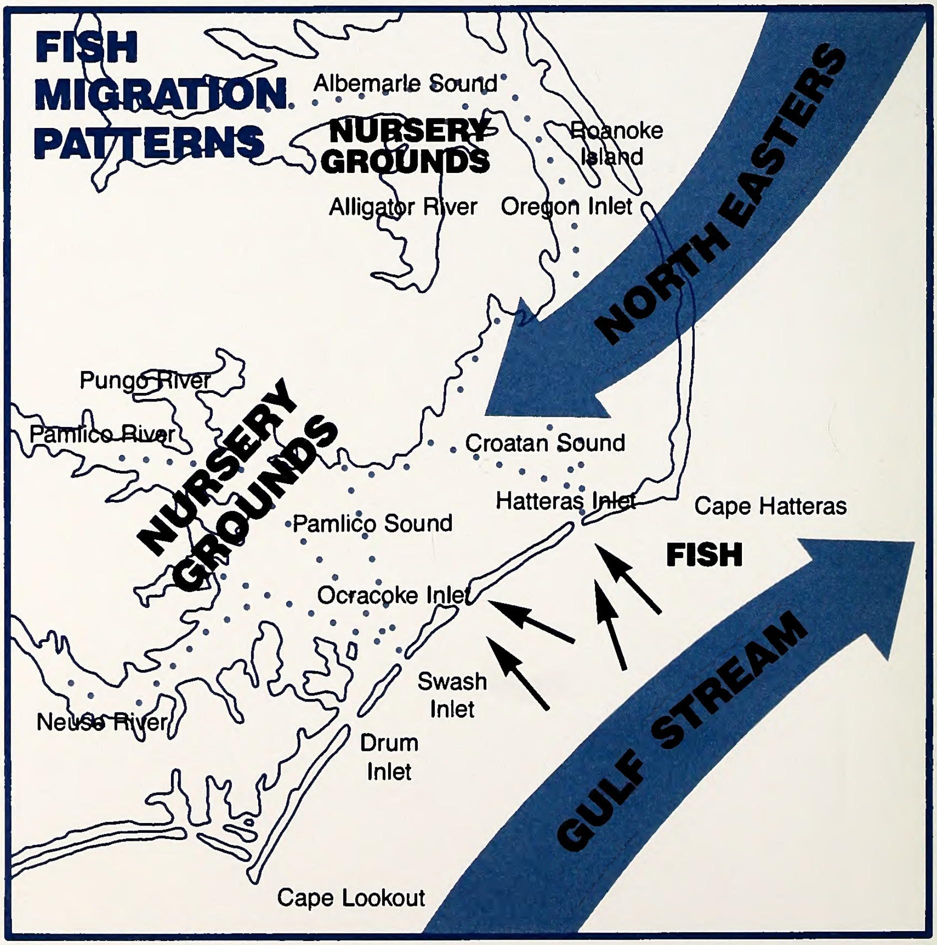
Sea Grant researcher Len Pietrafesa, an NCSU oceanographer, says the fish are ferried along by upwellings produced by the northward flow of the Gulf Stream. These twirling masses of undersurface water push toward shore carrying the fish to within a few hundred feet of the Outer Banks.

As they reach the coast, the infant fish are carried along a "conveyor belt" of shoreline currents, Pietrafesa says. If luck is with them, those currents push the fish into Pamlico and Albemarle sounds through Ocracoke, Hatteras and Oregon inlets.

Millions of them squeeze through.

Inside the sound, these small creatures become part of yet another amazing combination of wind and water.

In winter, cold fronts blow in from the northeast every seven to 10 days, their winds pushing the water of the sounds toward the barrier islands. Gravity creates an opposite current in bottom waters, carrying the fish into the estuaries. There, they will grow and develop into adult fish.



the Sounds

Menhaden fishermen

Photo by Bob Williams

Though millions manage to slip through the few inlets on the Outer Banks, millions more don't make it into the sounds.

The latter usually end up as food for other fish or as part of the conveyor belt migration that takes them southward toward the large bay surrounding the mouth of the Cape Fear River.

The fish that don't make it to the nursery grounds could be a key ingredient in determining the future management of the Albemarle-Pamlico system.

In recent years, much attention has been focused on dwindling fisheries in and around Albemarle and Pamlico sounds. Most people blame man-made pressures such as pollution, development and overfishing for the decrease in fish stocks. The numbers of fishermen have increased significantly, placing more pressure on the low-volume system.

"The first thing you think is the sounds must be polluted, that there's something wrong somewhere," Miller says. "We need to know whether this is right or not."

The low fish count could be due in part to the inability of some infant fish to make it through the inlets, Miller says. Fluctuations in water currents, winds and weather may help explain why some years are good for fishing and others bad.

There should be enough space and food for millions more infant fish in these large sounds, Miller says.

But overfishing is only one problem humans bring to the sounds. Man's intrusion into other facets of this fragile migration system can already be seen.

Poorer water quality—the result of agricultural runoff, too much development and other factors—could toss a monkey wrench into the natural workings of the sound.

Environmental pressures caused by habitat-destructive trawling in the sounds could also weaken some links in the migration chain, Miller says.

Both researchers agree that man's actions could have serious consequences for the annual fish migration patterns.

"But right now, all we know is that it's mostly affected by nature," Pietrafesa says. "Nature controls water temperatures, winds, air temperatures, and all that determines how many fish make it through the inlets."

Undersea Incubators:

By Michael Weaver

It's a quiet, calm scene, this place where the land meets the sea, where salt water mingles with fresh in a forest of marsh grasses and muddy bottoms.

Photo by Neil Caudle

If only you would peek beneath the surface.

Blue crabs burrow in a cloud of sediment. Tiny shrimp weave around clams and other crustaceans settled in the waist-deep waters. Spot, croaker and flounder dart among the seagrasses in search of food or in attempts to escape larger predators that would make a meal of them.

Estuaries are among the world's most fertile undersea environments. It is here that millions of fish and other ocean creatures migrate yearly to feed and grow before returning to deeper waters and continuing another spawning cycle.

Despite their importance and abundance of life—it is estimated that 90 percent of the fish caught by North Carolina's recreational and commercial fishermen spend some time in an estuary—the state had no protection there until the last decade.

By the mid-1980s, however, regulations prohibited a wide range of bottom-disturbing activities such as trawling, dredging and mechanical harvesting in shallow waters identified a decade earlier as valuable habitat.

By 1987, North Carolina had wrapped a protective ring around more than 128,000 acres of estuarine waters it had defined as nurseries worthy of keeping au naturel.

How have they fared?

"The struggle continues as to further protection," David Taylor said recently from his Morehead City office with the N.C. Division of Marine Fisheries.

Though the average fisherman knows he can't tow a trawl net through a nursery area or arbitrarily widen a channel for his boat, Taylor says inland farming and development practices play just as heavily on the health of a coastal estuary.

"Basically, everything east of Raleigh has to be coordinated to keep the nurseries up to par," says Taylor, manager of the division's four-county central district.

Bob Hines, a Sea Grant agent in nearby Atlantic Beach, agrees.

"Every time a housewife flushes a commode in Raleigh, a certain amount of it ends up down here," Hines says, standing amid the marsh grasses along the Newport River in Carteret County.

Farmers and fishermen have talked for 10 years about ways to curb field runoff of sediment and chemicals that, in the end, are going to find their way to the sea. Although Taylor believes "a whole lot of work" remains unfinished in controlling inland pollution, Sea Grant Director B.J. Copeland sees evidence of progress in the past decade.

"We have done a better job of identifying primary nurseries," Copeland says of an estuary's uppermost reaches that are more likely to house the youngest fish and shellfish.

More than 80,000 coastal acres are labeled primary nurseries, while another 48,000 acres carry designations of secondary or special secondary nurseries, downstream waters that fish move to on their way back to the open ocean.

In the sprawling Albemarle and Pamlico sounds, almost all protected nurseries are concentrated along the shallow, brackish waters of embayments opening out into the saltier sounds.

Nurseries—defined in part by their salinity as well as temperature, bottom type and food—typically include waters one-third as salty as the ocean. At about 10 parts salt

per thousand parts water, the warmer waters are more inviting to developing young fish and shellfish.

Large or sudden influxes of fresh water can disrupt that delicate balance, and fishermen often point an accusing finger at upstream farmers whose drainage ditches funnel fresh water down rivers into estuaries.

More and more, however, farmers are turning to techniques such as water management, strip cropping and vegetation lines designed to reduce runoff. In five years' time, Copeland says he has seen much improvement in the quality of water coming downstream and off fields.

He notes, too, that runoff isn't necessarily bad. An estuary, by definition, refers to that zone where salt water and fresh water meet. Land drainage is a permanent part of that picture.

"I don't know how one changes nature," says Copeland, who recently completed a detailed study of the Albemarle-Pamlico estuarine system.

"[Drainage] is not going to change," he says. "But you can change how it goes. How much water do you let loose when?"

Further restrictions on upstream use could be coming if the N.C. Wildlife Resources Commission agrees to extend nursery protections to waterways it controls inland of the estuaries.

Widening the existing nursery zones would help protect shrimp, crabs and other ocean animals that cross that imaginary line now separating estuarine waters overseen by Marine Fisheries—which recognizes nurseries—and the wildlife agency, which doesn't.

Last fall, the Division of Marine Fisheries suggested that wildlife officials add 10,000 acres to those areas already designated as nurseries. Inland waterways currently include no protected nurseries, though a wildlife official says disruptive activities such as trawling or dredging are not allowed anyhow.

"Most of the things [the Division of Marine Fisheries] protects, we don't allow in any of our waters," says Fred Harris, chief of boating and inland fisheries with the Wildlife Resources Commission. "There's not going to be a lot of additional protection, with the exception of possible [rules on] water quality."

The 13-member commission has agreed to call for a public hearing on the matter, and Harris says approval of the new nurseries appears likely.

Whether by expanded nurseries or by increased pressure to improve upstream water runoff, North Carolina must heighten efforts to save its all-important playgrounds for young fish and shellfish, Copeland says.

Unlike similarly sized estuaries in the Chesapeake Bay and Long Island Sound, North Carolina's estuaries are "relatively clean," he says—clean enough that they can be preserved.

"We've got to do it now," the Sea Grant director says. "If you don't do something now, you won't have a chance later." ■

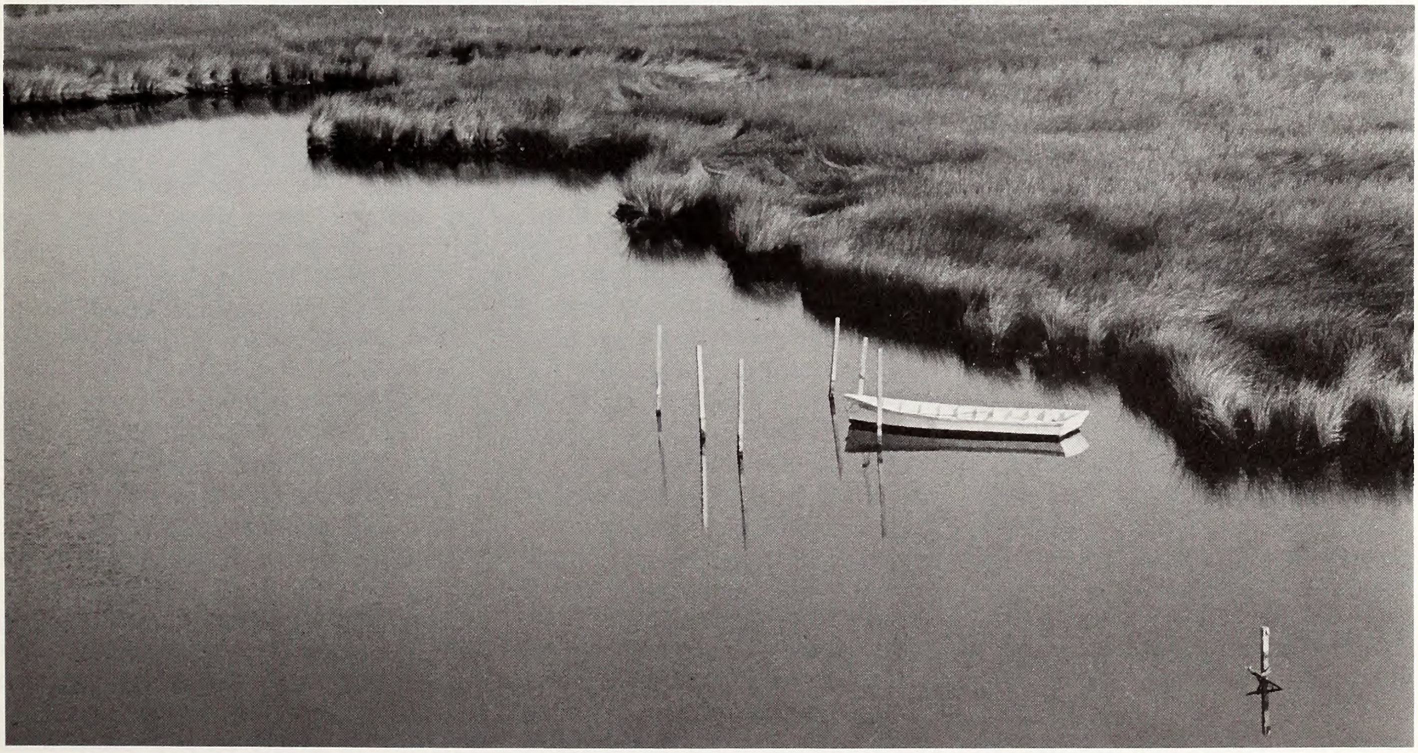


Photo by C.R. Edgerton

One Fish's Adventure

By C.R. Edgerton

Winter's approaching. I can feel the water cooling around me. Now and then, I have an urge to swim quickly toward the rising sun. There's a big ocean out there, they say.

I'm a menhaden. One of the most common fish in the sound. Coastal folks spend a lot of time trying to catch me and my family. We're small, but tasty and abundant, they say. They think they know about me and my kind.

But few people are aware of the magnificent journey I've taken during the first few months of my life.

I don't remember my earlier days. In my estuarine school, our teacher explained some things. "Your life did not begin here," the teacher said. "You were born in the warm and salty waters of the great Gulf Stream. As you traveled north you grew slowly. When you reached the coast of North Carolina, you were thrust toward the beach with great fury. Some days you traveled three or four miles."

"Wow," I thought. "That's not bad for a fish only a quarter of an inch long!"

The teacher explained that it took us about 60 days to reach the beach. "The water is shallow at the barrier islands," she said. "Currents running along the shore in a southward motion created a conveyor belt of water, carrying you and millions of your kin toward the inlets called Oregon, Ocracoke, and Hatteras.

"You are the ones who squeezed through the inlets and into the sound. Millions of your relatives didn't make it. They were carried farther south by the conveyor belt. But you became an involuntary participant in a unique process. As cold winter winds blew across the sounds toward the Outer Banks, the surface waters tilted eastward, stopping at the western shores of the barrier islands. It was much like tilting a bowl of water to one side."

I learned we were gradually carried westward as gravity pulled the sound's bottom waters toward the mainland. I like to think my swimming ability helped some here, but the teacher said no. "You were too small to swim that far in only a couple of months," she said.

National Marine Fisheries Service Photo

But I wasn't destined to be tiny all my life. By February or March I reached the estuary, a place described by the teacher as safe and calm and perfect for the growth and development of little fish. In just a few months, I grew about four inches, a respectable and boastful size.

Before the teacher left, each of us were told to expect some unusual changes as the waters in the estuary became cooler. "You'll feel an urge," she said. "You'll want to swim back toward the inlet and into the open ocean. You'll want to go back to the warm, salty waters of the Gulf Stream. And you'll want to make a family of your own.

"But don't be hasty. It's a long way to the sea, about 50 miles. And currents will not help you this time. You'll have to swim the entire distance."

The trip would not be easy. Before reaching the open sea, we would have to avoid what the teacher called natural predators: men with nets and fishing rods, and the bluefish that choke the inlets, waiting to gobble up as many small fish as possible.

The urge is stronger now. I know I must soon leave this safe place. When I leave, I'll remember the words of the teacher: "When you have conquered the obstacles, you will reach the open sea. From there you will again become part of a migration process that has involved your family for millions of years." ■

The Back Page

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When North Carolina's shrimp fishermen haul in their nets, they usually catch more than just shrimp. Finfish and other sea creatures are caught with them.

For shrimpers, the bycatch can be a nuisance. Because they're only after shrimp, they cull the other fish and toss them back into the water. Some of the bycatch don't survive. Also, culling is time-consuming for shrimpers; and too much bycatch can reduce the quality of the shrimp catch.

But shrimpers aren't alone in concerns over bycatch. Fishermen who seek the species thrown overboard by shrimpers say reduced bycatch will increase the number of fish they haul in.

That's where Sea Grant comes in. Marine Advisory Service agent Jim Bahen and others are beginning to gather ideas from shrimpers on how their gear can be improved to separate finfish from shrimp nets.

Since November, some progress has been made. With the N.C. Division of Marine Fisheries, Sea Grant set up a bycatch advisory committee that held its first meeting December 12.

During the meeting, committee members compared notes on the status of bycatch research and agreed to hold a workshop later in the year.

Meanwhile, Bahen continues his investigations into ways to construct finfish separator devices that could reduce bycatch by 50 percent. He hopes to come up with at least three designs that will be tested in laboratories and on commercial shrimping vessels.

"The key to the project's success will be the ideas we obtain while interviewing shrimpers," Bahen says. "Collectively, they have thousands of years on the water and I am confident we can use their suggestions to come up with a feasible design."

Landlubbers, let your senses explore the sights, sounds, tastes and feel of coastal North Carolina at the Second Annual Coastal Celebration in Raleigh. The two-day event will feature entertainment, educational exhibits, activities for the kids and authentic coastal fare.

You can hear champion goose caller Erleen Snow from Currituck and the rhythmic cadence of the Menhaden Chanteymen singers. For a feel for the coast, let your fingers do the walking at the marine touch tank. And let the smell of fried fish and Stump Sound stew lure you to pay the price of a good coastal meal.

And there's more.

The celebration will feature more than 40 educational exhibits. Sea Grant, the N.C. Wildlife Resources Commission, the N.C. Aquariums, the N.C. Maritime Museum and others will man exhibits that will teach folks what makes our coast unique.

And bring the kids. There will be special activities that will heighten your children's awareness of our coastal environment.

Sponsored by WRAL, the Coastal Celebration will be held in the Kerr Scott Building at the N.C. State Fairgrounds in Raleigh, April 7 from 10 a.m. to 6 p.m. and April 8 from 10 a.m. to 5 p.m. It's free and open to the public.

Stop by the Sea Grant booth. We'll be happy to tell you about our latest research and extension projects.

Working papers dealing with artificial reef programs and fisheries management policies have been published by Sea Grant.

A Policy and Management Assessment of Southeast and Mid-Atlantic Artificial Reef Programs by Sea Grant's Marine Advisory Service Director Jim Murray examines artificial reef programs in 12 coastal states from Texas to New Jersey.

Murray describes the status of the artificial reef programs and provides recommendations to develop effective state policies for artificial reef management.

A Methodology for the Analysis of Fishery Management Policies, with an Example of the North Carolina Brown Shrimp Fishery by Marc-david Cohen uses mathematical models to help determine the best opening dates for the brown shrimp fishery.

Murray's paper is $3 and Cohen's is $3.50. To order copies, send a check or money order to UNC Sea Grant, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605.

The Indians had a great idea. When European colonists began to settle America's coastal areas in the early 1600s, they were intrigued by the Indian's use of fish as fertilizer. Contemporary observers noted that Indian farmers dropped a small fish into each hill of corn planted.

Sea Grant's Rich Novak, a regional marine specialist on Roanoke Island, has taken the idea of fish fertilizer a step further. He's used waste from a fish-cleaning operation to make a form of compost that's raised the eyebrows of at least one coastal vegetable farmer.

Novak says his compost pile serves two purposes: it provides good fertilizer for vegetables, shrubs and other vegetation, and it demonstrates that fish waste doesn't have to be dumped offshore or into area landfills.

The compost pile was constructed of a layer of oyster shells (gravel works well, too), a layer of PVC pipe for aeration, a layer of peat moss or cornstalks, fish waste mixed with peat or wood chips and a final layer of peat, cornstalks or chips. The pile was not turned during the composting period, which took from 40 to 75 days.

A video on the composting project has

been shown on a Norfolk television station. A copy of the video is available in Novak's office in Manteo. For more information contact Novak at 919/473-3937.

Sea Grant is looking for committed men, women and youngsters who want a cleaner, safer environment and who wouldn't mind turning that commitment into positive action.

Site coordinators are needed for The Big Sweep '90, the annual statewide waterway cleanup scheduled for September 22.

If you know of a stretch of beach or a creek, river or waterway that isn't already under the watchful eye of a Big Sweep site coordinator, and you would like to lead a group of folks in cleaning it up, we want to hear from you.

For more information or to volunteer, contact George Norris, Streamwatch Coordinator, N.C. Division of Water Resources, Archdale Building, Raleigh, N.C. 27611. His telephone number is 919/733-4064.

***Coastwatch* is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.**

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City/State/Zip ______________________________

To help us specialize our services, please answer these questions.

I am in the following line of work:

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☐ Commercial fishing
☐ Educator
☐ Farming
☐ Homemaker
☐ Lawyer
☐ Marina operator
☐ Marine recreation
☐ Mass media
☐ Seafood processing/marketing
☐ State government
☐ University professor/researcher
☐ Other____________________
____

Coastal property owner: ☐ yes ☐ no   Boat owner ☐ yes ☐ no

$__________ contribution to defray printing costs for *Coastwatch*

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Coastwatch

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SEAGRASS SURVIVAL

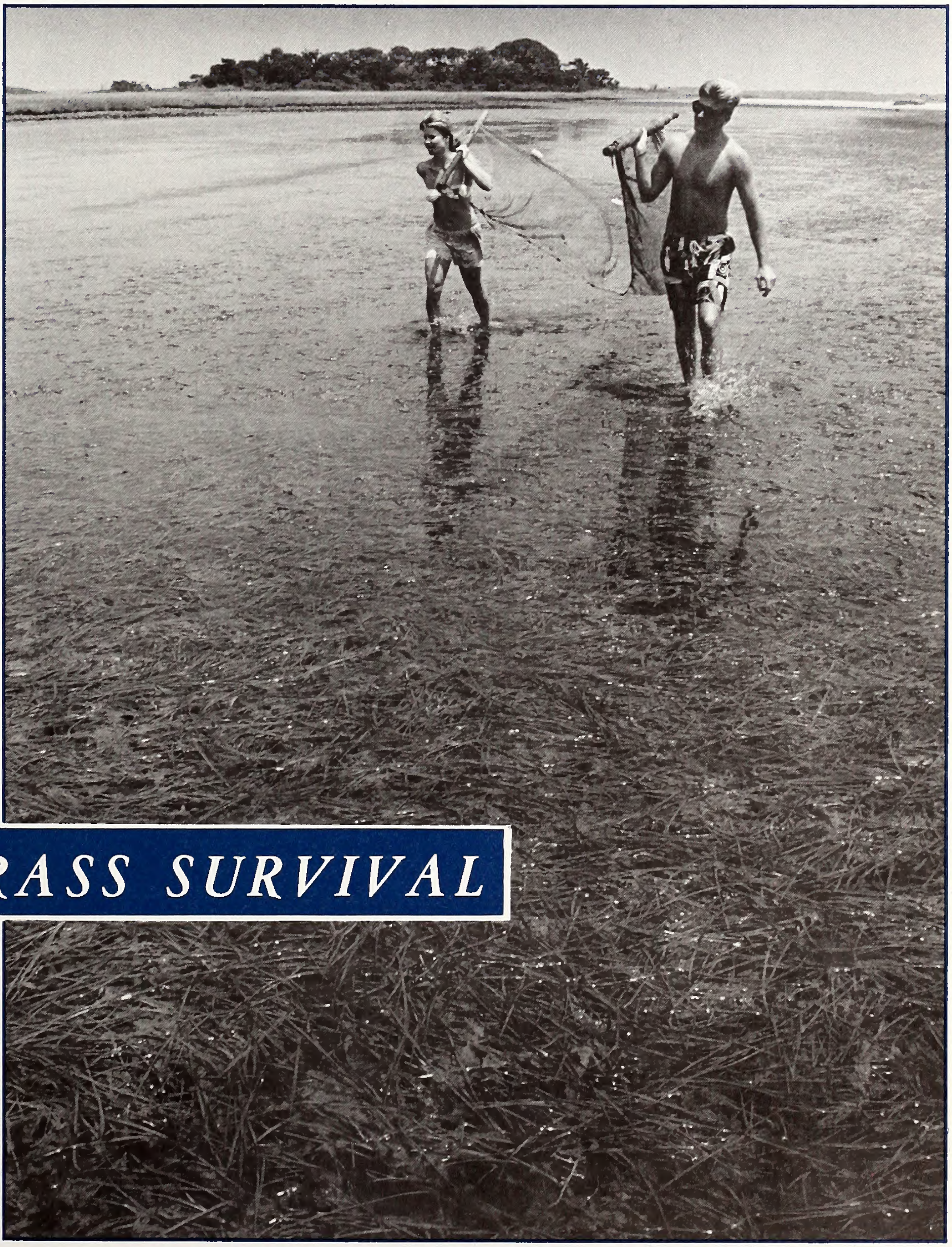


Photo by Scott Taylor

Two Duke University undergraduates pull a seine through eelgrass on Phillips Island near Morehead City.

EMERALD WAVES OF GRASS

By Michael Weaver

Their boats were all but loaded down and gassed up when the word reached clam fishermen last December: You can't kick for clams in these waters, the state said. There's grass here.

Grass?

Seagrass.

It had covered so much of the estuary floor through Core Sound that fisheries officials closed 20 percent of the available clam beds off Carteret County to mechanical harvesting that could destroy the underwater lawns.

The grass beds—discovered during aerial surveys last year—harbor many of the state's most important recreational and commercial species. Among the species are clams—a much-sought-after mollusk that supports an economically important winter mechanical-harvest fishery.

Closing these newly discovered grass beds had Carteret County shellfishermen angrier than a disturbed hornet. They needed to harvest the beds to make a living, they said.

But is today's harvest of clams worth destroying a habitat that's vital to tomorrow's production of many species of fish and shellfish?

Indeed, protected seagrass beds are nothing new. For years, the state has protected underwater meadows prized for their role as food sources and refuge for thousands of sea creatures.

Young mullet, spot, blue crabs and hard shell clams share the cover of seagrass with adult sea trout, flounder, shrimp and dozens of other species. Bay scallops make seagrass fields their sole nursery grounds, and sea turtles as well as birds from egrets to osprey eat the wavy green leaves.

Dense seagrass fields cover up to 200,000 acres of shallow coastal waters in North Carolina, second only to Florida in area. And only in North Carolina does eelgrass—the most common along U.S. shores—coexist with two of the other 47 varieties known worldwide.

The unique habitat makes for a wonderful playground for fish and shellfish, an occasional battleground for fishermen and a fascinating study ground for scientists.

Salt marshes, which cover roughly the same number of acres in North Carolina, are certainly more visible, but no more valuable, experts say.

"These are critical nursery habitats," says Gordon Thayer, a scientist with the National Marine Fisheries Service and an authority on seagrasses. "Without them we think we would have different animals using the habitats—and a lot fewer of them."

Marine scientists who have spent the better part of careers studying seagrass still fascinate at its size, beauty and productivity. A healthy patch of seagrass—they vary in size from 1 acre to 6,000—can rival the productivity of a heavily farmed agriculture crop.

"It's just teeming with all sorts of things," North Carolina State University botanist JoAnn Burkholder said while flipping through pages of color slides of the neon-green seagrass beds.

As part of a Sea Grant research project, Burkholder and NCSU zoologist Larry Crowder have transplanted some 8,000 eelgrass shoots in a dozen mesocosms, 380-gallon tanks set up along the docks at Bogue Sound. Their tests to determine its resistance to algae and other clinging plants are among the first long-term experiments

Photo by Scott Taylor

of seagrass in controlled environments of that size.

Little is known about seagrasses, admit researchers who until this century focused little attention on the stringy plants. Losses, too, are hard to document since few records mapped their growth before the mysterious "wasting disease" of the early 1930s that wiped out 90 percent of seagrasses along the Atlantic shoreline.

What *is* known is impressive.

Eelgrass—along with shoal grass and widgeon grass in North Carolina—curbs underwater erosion through roots that anchor soils to the sound bottom. Since seagrass typically grows in shallow estuarine waters, its destruction can drastically alter the shape of the nearby shorelines.

Though seagrasses are rarely found in what Burkholder calls "wave-beaten areas," they do flourish along more protected embayments along some coastlines. Throughout Core Sound, however, 88 percent of the three varieties are concentrated along the calmer, inner shores of Core Banks.

The roots—spaghetti-like strands that dig deep into muddy bottoms—also draw nutrients from the soil, passing that energy along to other plants and animals when the seagrass plant dies or exfoliates each season.

A century ago, long, tough strands of eelgrass were so common along New England shores that residents there scooped up wagonloads of shredded seagrass and thatched roofs with it.

To this day, seagrasses—largely recovered from the wasting disease—"grow like carpets, like your back yard," Thayer says.

In the dense, tangled leaves, microscopic and more visible plants and animals attach themselves to the plants and hide among their thick mat.

Outside the calm of seagrass beds, fish and shellfish fend for themselves without cover of the sprawling, protective canopy. Bay scallops search out seagrass beds, where they grow from larvae.

When wasting disease ravaged so much of the Atlantic Seaboard's seagrass from 1930 to 1933, the impact was immediate. Harvests of scallops in the Delmarva Peninsula of Chesapeake Bay that had totaled 25,000 pounds in 1930 plummeted to zero by 1933 and '34.

More recent declines in seagrass in the Chesapeake Bay are blamed on pollution and dredging, a deadly combination brought about by coastal development that chokes the life from seagrass. Because they are plants dependent on light for photosynthesis, seagrasses suffocate under cover of turbid waters or heavy algae that block the sunlight needed to make food.

With no light, there is no life—the reason you find most seagrasses in waters 6 feet deep or less. Multilayered meadows thrive in shallow waters along most of the earth's continents, from the Arctic Circle to Tasmania.

Dredging and filling remain seagrasses' most direct enemy, though outside influences that alter water temperature, salinity and light also pose a threat.

Like the Chesapeake, North Carolina's coast has seen drastic development in the past generation, but Thayer and others are not ready to link that buildup with a downturn in seagrass.

"We don't have a particularly good historic record," he said from his Beaufort office. "There just aren't any historic maps."

Researchers agree, however, that seagrass in the Beaufort area has waned little over the past 20 years.

Only in that time have federal and state regulators entered the scene, writing laws to protect seagrasses from potentially destructive activity such as dredging or mechanical harvesting.

"It's pretty clear that these practices such as clam-kicking are destructive to the bottom," researcher Charles Peterson says of mechanical methods that use hydraulic dredges or boat motor propellers.

"You can see those trails for years," Thayer says.

Add to the equation the wandering nature of seagrass beds, and it's clear why the protection puzzle is a complicated one.

continued next page

Aerial view of seagrass beds surrounding a duck blind in Core Sound near Davis, N.C.

Photo by Scott Taylor

Eelgrass

Photo by Scott Taylor

As many as 100 clam fishermen marched a picket line around the Marine Fisheries building in Morehead City last month, demanding opening of closed waters in Core Sound.

Division Director William Hogarth refused, agreeing that while some areas had less grass than earlier thought, grass beds have a tendency to move from season to season.

Peterson, of the UNC Institute of Marine Sciences in Morehead City, puts it this way:

"If we'd decided to dredge Core Sound out one year because we'd said it didn't have seagrass, we'd have been wrong.

"There's a lot we don't know," Peterson admits.

But, he adds, the lifeblood of ocean life is tied so closely with seagrass habitats that, "if all the seagrass [suddenly] is missing, we'll know." ■

CURRITUCK SOUND: LESSONS LEARNED THE HARD WAY

By C.R. Edgerton

Before the turn of the century, fishermen on North Carolina's Currituck Sound would often lean over the sides of their boats and take long, cool drinks from the sound.

Outdoorsmen would travel great distances to camp under clear skies, hunt the masses of waterfowl and fish for largemouth bass.

The shallow waters of Currituck were clear then and, because a hurricane had closed the sound's only link with the Atlantic Ocean in 1828, they were more fresh than salt. Fish were abundant and swam in playful schools. Migratory birds nested there by the thousands. The sound was pristine, untouched by the ravages of civilization.

Native submerged seagrasses, tiny but essential ingredients in the fragile ecology of this Eden, flourished. Fish, shellfish and other coastal creatures found shelter, food and protection here.

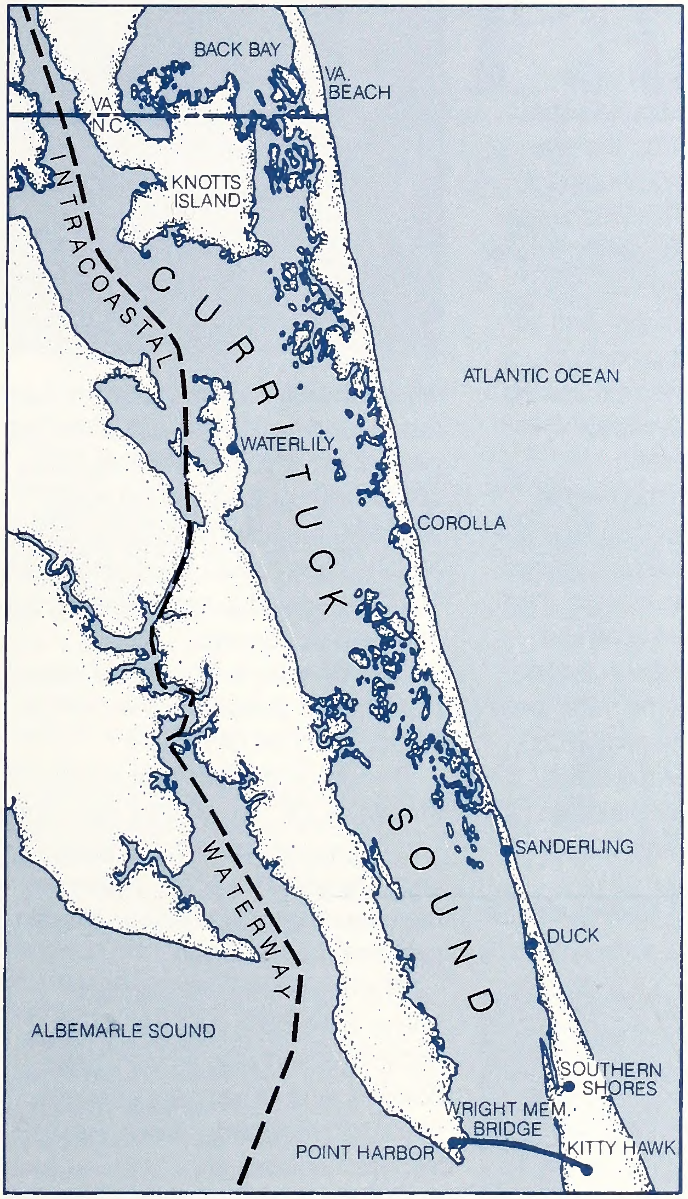
Through the years, the fortunes of Currituck have hinged on the ebb and flow of the sound's seagrass beds. Lessons learned here have prevented similar situations in the state's other sounds.

In 1918, the residents of Currituck Sound—the people as well as the flora and fauna—witnessed an apparently innocent event that would one day mean disaster for the then tranquil, unpolluted waterway.

Construction was completed on a series of canals and locks that linked Currituck with Norfolk Harbor and the Chesapeake Bay via North Landing River. The canal connected the Carolina sounds with Virginia's busiest waterway, uniting the two states by inland water and bringing progress and growth.

But the plan backfired. The new waterway brought not only commerce and trade, but allowed some of the dirtiest water on the Eastern Seaboard to flow unhindered from the polluted Chesapeake Bay to Currituck.

Raw sewage. Silt from continuous



The fortunes of Currituck have hinged on the ebb and flow of the sound's seagrass beds. The Intracoastal Waterway links Currituck Sound with Norfolk Harbor and the Chesapeake Bay.

dredging. Industrial wastes. They had begun to strangle the huge Virginia bay and were now making a home in Currituck Sound.

The pristine beds of seagrass began to choke beneath the turbid waters. The muck and mire of too much pollution spelled doom for sago pondgrass, widgeon grass, wild celery and other grasses essential to survival of the sound's underwater creatures.

Hungry fish moved to healthier waters. Most of the migratory waterfowl chose not to return to their normal nesting sites. The fishermen could no longer drink the waters of Currituck, which were now rank with the odors of civilization and salty from the influx of Virginia seawater.

But things began to improve in the early 1930s. W.S. Bourne, a scientist who dedicated much of his life to trying to discover the causes of the death of Currituck's seagrasses, urged officials to redesign the series of locks and canals linking the two states.

The new design worked. For the next 30 years, Currituck Sound allowed Mother Nature to clean out the sludge and sewage that had accumulated there for two decades. The vital seagrasses returned, though not in their earlier abundance.

The bass also returned, luring fishermen from around the United States to the Currituck low country.

The old hunting clubs, built to house waterfowl hunters, flourished again as most of the migratory birds reclaimed their nesting sites.

But the fragile Currituck ecosystem and its vital underwater seagrass beds had not seen the last of their troubles. Hurricanes in 1954 and 1955 stirred sediments, clouded the waters and choked native grasses.

And, in March 1962, the powerful Ash Wednesday Storm blew in from the northeast, pounding North Carolina's Outer Banks and opening several new inlets into Currituck Sound. Salty seawater poured in, transforming the sound from a freshwater haven to a brackish sea.

The sudden influx of seawater decreased much of the turbidity that had choked the widgeon grass, wild celery, and other native underwater grasses. The inlets later closed, and the saltiness of the water diminished. But the brief period of increased salinity cleared the water and opened the door to yet another challenge for the Currituck system.

Eurasion watermilfoil, a thickly growing underwater plant that robs its host waterway of life-giving oxygen, gained a foothold in the sound. Scientists believe the milfoil, a non-native species, was transplanted by accident, off boats plying the canal between milfoil-choked Chesapeake Bay and Currituck Sound.

Again, local fishermen began to see the consequences of the destruction of native seagrass beds. Fewer fish were caught. Fewer sea birds were seen. Boat propellers were often clogged and even stopped by this choking underwater weed.

continued next page

Photo by Jim Page

But Mother Nature was not yet finished with Currituck Sound's seagrasses. By the late 1970s, the salt-heavy seawater that had poured into the sound during the Ash Wednesday Storm had disappeared. Lighter, fresher water prevailed. The milfoil began a decline that continues today. And scientists aren't sure what process or combination of processes caused the choking weed to wither, especially in southern parts of the sound.

"Invading weeds like this tend to take over for awhile and then fade out," says East Carolina University biologist Marc Brinson. Perhaps, he says, the milfoil's decline can be traced to a series of weather-related events like those that destroyed some milfoil beds in Pamlico Sound in the mid-1980s.

Today, nearly half the milfoil that once dominated seagrass beds in Currituck Sound is gone, says Brinson who, with ECU biologist Graham Davis, has studied and written about the seagrasses in the sound. They say some of the native grasses are returning.

ECU's Graham Davis studies milfoil in Currituck Sound.

But the fish haven't yet come back and the birds haven't been convinced that Currituck is the right place to nest and raise their young.

Ernie Bowden, a 65-year-old lifelong resident and observer of the Currituck Banks, thinks he knows why.

"The seagrass beds disappeared in the late 1950s, though right after World War II they were abundant," Bowden says. The absence of the seagrasses began a chain of events that Bowden says can't be reversed.

"The real problem in Currituck Sound is the filling in of the sound because of shoreline erosion," says Bowden, who remembers when the sound's five-foot deep waters were 12 feet deep or more.

"Once the grasses disappeared, the waves just rolled in at will, cutting away at the shore like crazy. When I was a boy it was unusual to see a wave even 18 inches high. Now it's not unusual to see them three feet or more."

Bowden admits his observations of the sound are not truly scientific. "But I've lived here all my life and my father did and his father before him," he says. "I've witnessed what's happened here."

The most obvious change brought about by the death of Currituck's seagrasses has been the decline in fish and bird populations.

"In 1957, we began to see the demise of the migratory waterfowl and bass," says Bowden, who once operated a private hunting club near Corolla. "Hunting and fishing like they used to do with the big hunting clubs is practically history in Currituck Sound. There's just nothing for them to eat here anymore."

Will the sound ever return to its glory days, when its waters rolled clean and fresh and the residents along its shores enjoyed its beauty?

"In terms of waterfowl, it probably won't," says Brinson. "But it's not just the seagrass beds that are a problem. They need to stop the excessive hunting in the area, to preserve the species that do come there."

Brinson says some of the seagrasses that died in the 1960s and 1970s have returned to portions of Currituck Sound and Back Bay. And in areas where milfoil once dominated, the seagrasses are making a comeback.

He also says excessive erosion in Currituck hasn't been positively linked to the demise of seagrass beds. "In fact, if there's filling in the sound and the depth of the water is less than it used to be, that would make conditions better for the growth of seagrasses, which need shallower water to survive," he says.

But Bowden has a less optimistic view. He thinks future visitors to Currituck Sound will never again witness the bountiful waters that he grew to love as a young boy.

"I don't think it will ever be the same again," Bowden says. "When some things are messed up, they're messed up for good." ■

The Back Page

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You've just bought your dream cottage by the sea, and around it you envision lush greenery and flowers. You start thumbing through seed, bulb and plant catalogs to make the most dramatic selections.

Stop.

This vision of vegetation can lure even the greenest thumb to disaster.

Along the oceanfront, the rules of plant selection, use and culture are subject to drastic revision. The salt spray, beating sun and dry, loose sand can kill inland varieties of plants, shrubs and trees that are not adapted to tolerate the harsh oceanfront environment.

Karl Graetz, a horticulturist and author of *Seacoast Plants of the Carolinas,* says homeowners can't expect to change their beachfront homes into tropical paradises.

Instead, Graetz advises that coastal gardeners choose native plants and shrubs.

Those plants have adapted to the coastal environment and, they're salt hardy, Graetz says. "Besides, the native plants are really gorgeous, and most people don't recognize that."

Homeowners can consult with coastal nurserymen about their plant selections. Or they can familiarize themselves with Graetz's 206-page *Seacoast Plants* book.

Seen as the bible for coastal landscaping, *Seacoast Plants,* now in its sixth printing, has helped thousands of coastal residents take a practical approach to seaside planting.

For a copy of this informative book, write UNC Sea Grant. Ask for publication UNC-SG-73-06. The cost is $4.50.

You always order flounder. Fried. You're afraid of oysters. You're not alone.

For many Americans, seafood is an unknown, at least when compared to more familiar fare such as beef, chicken and pork.

"They're overwhelmed with seafood. There's so many species," East Carolina University scientist David Griffith says. "It's like they're saying 'Well, fish is fish.' "

Griffith and fellow ECU anthropologist Jeff Johnson arrived at that conclusion after a recently completed Sea Grant study of seafood consumers.

In two years of interviews, market research and just plain observations of the way people eat, the two pinpointed regional differences in seafood preferences and preparation as well as times in our lives when we're open to influences that could change our eating habits.

Most surprising, Griffith says, is that distance from the coast "had less to do with seafood consumption than whether they lived in a rural or urban area."

Of the four consumer groups studied—coastal urban, coastal rural, inland urban and inland rural—only in the latter did eating habits shift significantly from changes in the family, such as marriage or the birth of children.

Consumers in the other three groups most likely altered eating habits for health reasons or at the advice of friends or co-workers.

In comparisons according to race, cooking styles and seafood preferences followed fairly separate paths. Whites tended to fry foods less and favor fresh fish fillets, shellfish and imitation seafood products more than non-whites. Whites also ate more frozen processed fish products.

Such data is of particular interest to seafood manufacturers and marketing firms, who use the information to adjust everything from advertising to supermarket shelf placement.

The industry's real task may lie in teaching consumers the types of seafood and easing the apprehension many still feel toward anything but steak and potatoes.

When asked to group photos of different meats, consumers consistently separated beef, pork and chicken from each other, but tended to lump all seafood together. The average buyer would, for example, differentiate chicken nuggets from a whole chicken, but not make the distinction between fresh flounder and fish sticks.

"In fact," says Griffith, "there's a bunch of really good different seafoods out there, and if people stopped lumping them all together, they'd find a lot to choose from."

Griffith and Johnson's final report is due out this spring. The two are now participating in a study on seafood consumers' reactions to news of coastal pollution.

North Carolina's coastline became famous as The Graveyard of the Atlantic for good reason.

For 400 years, ship captains have known of the hazards of navigating off the Tar Heel coast. And many captains disregarded warnings and lost their ships to the ravages of shifting sands and unsure winds.

Hundreds of these wrecks have been found and are noted on maps kept on file at the National Oceanic and Atmospheric Administration office in Rockville, Md. The files include information about the ships and how and when they became victims of The Graveyard of the Atlantic.

The files contain full descriptions of some of the wrecks and are noted with Loran-C coordinates. Others are marked on the maps but are simply described as "unknown." All known wrecks and obstructions in U.S. coastal waters are covered.

For more information about wrecks in your area, write to the Operations Section N/CG241, National Ocean Service, NOAA, Rockville, Md. 20852.

While winter's cold winds whirled around your home, you made up your mind. After years of thinking about it, you're finally going to buy a place at the coast.

Before you lay down your hard-earned

continued next page

cash for a piece of land that's bathed in warm ocean breezes, read UNC Sea Grant's publication "Your Place at the Beach: A Homeowner's Guide to Vacation Real Estate."

The guide, written by Sea Grant's legal specialist Walter Clark, addresses the environmental hazards, ownership options and costs of coastal real estate. The 28-page book covers what you can expect when buying cottages, condominiums, time-share and other shoreline properties.

Written with the consumer in mind, the practical handbook answers basic questions anyone might have when considering the purchase of coastal real estate.

For your copy send $2.50 to UNC Sea Grant. Ask for publication UNC-SG-87-04.

Tired of roast beef and potatoes? Pork chops and rice? Like to add a little coastal flavor to your meals?

Then subscribe to Sea Grant's latest newsletter, *Mariner's Menu.* This bimonthly newsletter, written by seafood education specialist Joyce Taylor, can bring a taste of the coast into your home.

Mariner's Menu will focus on different seafood topics and include six to 10 recipes. Taylor develops the recipes, then calls on the Carteret County Extension Nutrition Leaders to test and evaluate the resulting dishes.

Upcoming issues include information and recipes for poaching and steaming seafood, hybrid striped bass and outdoor grilling.

If you'd like to subscribe to *Mariner's Menu,* write UNC Sea Grant. Ask for UNC-SG-NL-07.

Don't forget to mark your calendar for the Second Annual Coastal Celebration April 7 and 8 at the Kerr Scott Building on the State Fairgrounds in Raleigh.

Sponsored by WRAL-TV, the celebration will offer landlubbers a glimpse into coastal culture, ecology and issues through exhibits, demonstrations and entertainment. And you'll be able to satisfy your hunger with a taste of coastal fare.

Celebration hours are 10:00 a.m. to 6 p.m. Saturday and 10 a.m. to 5 p.m. Sunday.

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Photo by C.R. Edgerton

River Herring. Like droves of blackbirds, the herring come. They converge, funneling through the sounds and into the rivers. They've fostered the economy, health and traditions of many coastal communities. But the herring's days seem numbered. The annual spawning run of this fish is dwindling. Who or what is to blame? This month, *Coastwatch* takes an in-depth look at the river herring fishery in North Carolina.

Where have all the herring gone?

BY KATHY HART

Murray Nixon

Murray Nixon knows river herring. He knows how to stake a pound net just off the shore to get a herring to "play into" the lead, the heart, the tunnel and finally the "crib," where it's as good as in the frying pan.

He knows what it is to eat herring three times a day and be happy that he could put meat in the bellies of his young 'uns.

And he knows that the herring fishery, the source of much of that meat for several generations of Nixons, is dying a slow death.

Nixon has lived a lifetime about a mile from the Chowan River. He's fished herring commercially, sold it at his fish house and now helps manage it as a member of the N.C. Marine Fisheries Commission.

As he rakes his hat back across his salt-and-pepper crew cut, he talks about the fish he knows.

"They would come in like droves of blackbirds. . . play along the shoals into millponds and ditches, roll around among the cypress and spawn," he says.

But no more.

"Last year was the sorriest year we ever had for herring," Nixon says bitterly.

River herring catches plummeted during the last 15 years, bottoming out in 1989 at a little more than 1.4 million pounds. In its heyday, this Albemarle fishery netted more than 40 million pounds of river herring.

"It's the runoff from farms, manufacturers and septic tanks," he says. "And there's more people living on the waters."

As evidence of the pollution, he describes the mats of blue-green algae that have coated the Chowan River "like paint" during the summers since the 1970s. The algae, he claims, cuts off the oxygen supply to eggs and young fish.

"You got to hatch 'em to catch 'em," he says with a note of finality.

And he's right.

Charles Manooch, a research biologist with the National Marine Fisheries Services in Beaufort, has studied the river herring and other fish of its kind, striped bass and shad.

They're anadromous fish. They live as adults in the ocean but move to fresh water to spawn. Like herring, the spring runs of striped bass and shad have also waned.

Manooch believes the herring's instinctual return to the rivers to propagate may be its roadblock to survival.

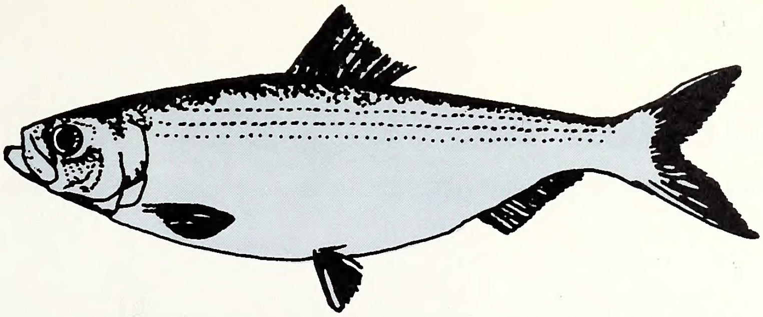
The Chowan and Roanoke, the core rivers of the North Carolina herring fishery, show the signs of human intervention and abuse.

Dams and other water projects have altered the natural flow of these rivers, Manooch says. Spring floods now last for weeks instead of days, changing key environmental signals for these fish of inbred habit.

These instincts also drive herring to

Photos by C.R. Edgerton

A pound net in the Cashie River awaits the annual herring run.



return to their waters of birth.

"Herring seek shallow fingers of waters—ditches, millponds, creeks with sometimes only two to three inches of water," Manooch says.

But often the fish find access to these natal streams cut off by bridges, highways, building projects and beavers.

And what man hasn't altered, he's polluted, Manooch says.

The discharge from industries and waste treatment plants and the runoff from farms, forests, city streets and backyards funnel nutrients into the sluggish Chowan and swifter Roanoke.

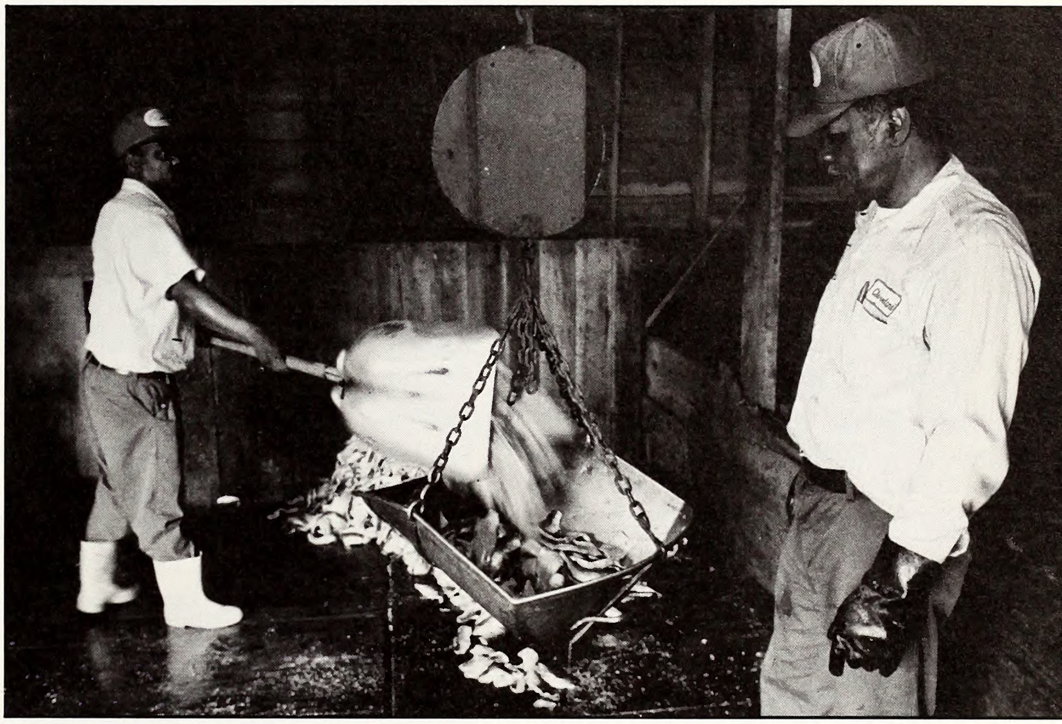
During sultry North Carolina summers, the nutrients trigger blue-green algal blooms that choke the Chowan River. The blooms, Manooch says, are sometimes toxic to the fish. Other times they rob the river of needed oxygen or crowd out tiny plants the herring find more edible.

"Anadromous fish populations are declining because they must come upriver to spawn and this deeply connects them with man," Manooch says. "And man has not been kind to rivers."

Lee Wynns, co-owner of Perry-Wynns Fishery Co., once the nation's largest herring processing plant, also speaks disparagingly of the quality of the Chowan water that runs beneath his shoreside plant.

"Herring are just like you and me," he says. "If we're traveling, we'd rather stay at a clean place than a dirty one."

But once the herring return to the ocean, they have faced another problem: fishing pressure created by fleets of huge factory ships capable of netting and processing enormous catches. Foreign fleets scooped up tons of the fish during the late 1960s and early '70s.



Workers process imported Canadian herring at the Perry-Wynns Fishery in Colerain.

Fishery managers blamed these factory ships for the initial, sharp decreases in North Carolina landings later in the decade. Seeing the effects of the high sea heists, state and federal managers restricted offshore fishing.

But by then the damage was done.

Perry-Wynns' vats no longer brimmed with pickled and salted herring. The days of million-pound processing were gone. Now Wynns counts himself lucky to cut and salt a million pounds of the bony fish in a whole season.

With the drop in available fish also has come a decline in consumer demand, Wynns says.

Herring costs too much now to be the poor man's fish that once fed the multitudes of eastern North Carolina. And, with the push for healthier, quick-fix foods, people no longer hunger so much for herring slow-fried to a crispy brown.

So, what does tomorrow hold for the herring fishery?

An upstream battle.

Between fishing pressures and poor water quality, it may just be a matter of "whether the herring can hang on," Manooch says.

Murray Nixon shakes his head sadly. "The fish just keep going away," he says in a gravelly voice. "And people ain't going to eat herring anymore anyway. There's too many bones, and they don't have time to fix 'em."

But the bony fish don't stick in Nixon's craw. "I love to eat 'em, love to smell 'em and love to work in 'em," he says. ■

"A million herring in one night..."

BY CARLA B BURGESS

It has been said that the foundations of Amsterdam were laid on herring bones. A little digging in coastal North Carolina history shows that the community timbers there, too, rest on the bony fish.

"In the bygone days, it was essential that everyone have a barrel of herring," says Phillip Cecil "Tee Wee" Blount of Jamesville. "It depended on how many you had in the family as to how many herring you needed."

Salt herring fed the masses, without regard to class or wealth. The fish, high in protein and calories, were a cheap and abundant source of food and a cog in the region's economic wheel.

"It was one of the few foods we could get that was cheap," he says.

In those days most of the herring caught ended up on the table. Today it's used mainly for fish bait and animal feed.

"We sold fish to anyone who would buy them," says Murray Nixon, a commercial fisherman in Edenton. He recalls that he and his father would count out 200 to 300 herring in a "washed-out fertilizer bag" at $5 per thousand. "All the families would come down to the river and buy their fish for the year."

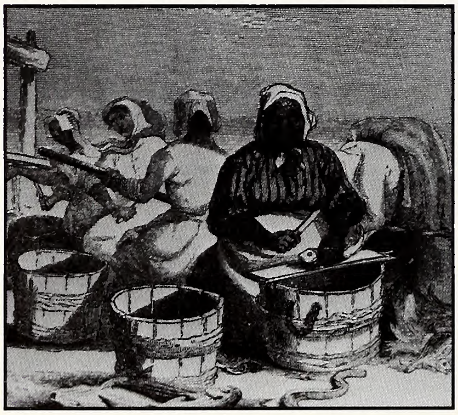
Nixon says his family kept two or three barrels in a smokehouse for their own use, each containing about 3,500 herring. The fish were preserved in various ways—pickled, dried or "corned," meaning cut and salted.

Nixon said his father drove a mule and cart down to the river to fish and would send the animal to and from the house throughout the day, the flat bed laden with herring each trip.

"I started out fishing with my father and as the years progressed got my own rig," says Nixon, whose youngest son Ricky now heads up the fishery operation.

The fishing scene in and around the Albemarle Sound is rich in history. The further back one goes, the more lively the picture.

Reporter and adventurer Porte Crayon, in an 1857 spring issue of *Harpers New Monthly Magazine*, describes the shores of the Chowan as "teeming with life and activity." At Colerain, "busy crowds composed of whites, blacks and mules wage unceasing war upon the shad and herring," he wrote.


N.C. Division of Archives and History

Porte Crayon's view of women "cutting" herring in 1857.

The Belvidere Fishery, Crayon wrote, was a protrusion of sheds and buildings, toward which the fishing boats would approach, the dotted cork lines of their seines enclosing the beach in a semicircle.

He described the tremendous hauls—sometimes negotiated by teams of mules—which landed as "a wriggling mass. . .ten or 15,000 voiceless wretches, whose fluttering sounds like a strong rushing wind among the leaves. . ." They were scarcely landed before they were "beheaded, cleaned and salted away."

The annual herring run, crucial to the wealth of the region, was "a subject of as general conversation and all-absorbing interest to the inhabitants as is the yearly overflow of the Nile to the Egyptians," Crayon wrote.

A seine of that time—2,700 yards long and 24 feet deep—was laid upon platforms on the sterns of two heavy 10-oared boats and could involve more than two miles in aggregate length, the reporter said.

Commercial fishing in the Albemarle region pre-dates Crayon's account.

The first fisheries on the Chowan River date back to the early 1700s, and seine fishing was reportedly taking place by 1765. Products of the fishery were exported—the higher grades of salted and pickled herring to Portugal and Spain and lower grades to the West Indies.

A German immigrant, John Penrose Hettrich, was credited with introducing "pound" nets—a stationary trap of stakes and net—in the region after coming here from fishing the Great Lakes in 1869.

The pound net afforded greater hauls with less manpower. In 1890, one pound-net fisherman reportedly caught a million herring in one night.

Even further back, herring are prominent in the history of the early colonial settlements. Herring and other abundant fish were used as money and bartered for sugar, spirits, coffee and other goods.

When asking about the heyday of the herring, one may hear references to the rivers running black with herring and to the flipping and splashing of the silvery fish along the shoreline during spawning.

The fishery in Chowan County was

N.C. Division of Archives and History

In the early years of this century, herring nets were hauled in by boats with steam engines.

reportedly yielding a billion herring a season by 1880. Fisheries and wildlife officials determined in the 1960s and 70s that in good years, more than a million herring were taken by recreational fishermen using dip nets.

As recently as the 1950s, Perry-Wynns Fishery Company in Colerain—once considered the largest freshwater herring processing plant in the world—saw seasons with as much as a million pounds of fish per day processed there.

"Every bit of that was right out of this river," said co-owner Lee Wynns, whose herring processing now is closer to 25,000 pounds per day and is not heavily dependent on local catch.

The herring themselves, as well as the demand and labor force, continue to decrease in numbers.

Changing eating habits, accompanied by a changing economy, have lessened the role of herring in today's society of convenience, the old-timers say.

"Anybody 50 years old and down ain't going to eat too many herring," says Nixon. "Everybody now has got too much money to eat herring."

Still, during spring, the driveway down the hill to the Cypress Grill and nearby River's Edge in Jamesville is lined daily with cars as visitors crowd inside for the crisp-fried herring and a taste of nostalgia.

Outside along the riverbanks there's a hint of sadness in the faces of some of the fishermen and onlookers over the fish's decline. But from his grocery in town, Blount—who has a small supply of corned herring for sale up front—just accepts it.

"The Lord knows what we need," he says, "and when we needed herring they were here." ■

Hard times for herring fishermen

BY C. R. EDGERTON

Guy Cox sits on the hard clay bank of the Roanoke, munching on a river herring fried so brown you can't tell where the fry ends and the meat begins.

"May as well sit here and eat 'em, I sure can't catch any," says Cox, the 23-year-old son and grandson of fishermen-farmers.

The familiar white rubber boots of the river fisherman are pulled midway his calfs. His jeans are muddy and his face carries the pink trademark of windburn.

The coffee-with-cream colored river is cold and swift. It runs high and heavy with silt.

Cox has been on the water since early morning, doing everything the way his daddy taught him years ago.

Plow your boat upriver about 500 feet. Coax your gill net to flow evenly out the front of your wide-bodied john boat. Allow it to drift as you float about a quarter of a mile downriver. Then swing your boat back around to the southside of the churning river and pull the net in, sliding the herring into the boat as you pull.

But this morning the fishing has not been what it once was, when he and his daddy happily lugged in as many fish as the small boat would hold.

"I didn't catch nothing worth talking about today," says Cox, an industrial electrician who fishes commercially

Guy Cox

only during the annual herring run in March and April.

"Five or six the first drift and maybe seven the second. That's nothing compared to what people used to catch on this river."

He's younger than most Roanoke River fishermen—he was initiated into this annual rite of spring at four years old—but he remembers when fishermen would catch 100, maybe 200 herring in a single drift.

"I could get out there with my daddy, and we'd have so many fish in the net we'd have to haul them in real fast so the boat wouldn't sink before we got to shore," he says. "It certainly ain't like that now."

He recalls stories from his father and other longtime Jamesville residents who remember the haul seine that operated just across the river until World War II.

The long net would be floated to the river's south bank, then hauled back with a steam-powered winch to the north shore. Old timers saw thousands of fish per haul, he says.

Cox watches several other fishermen drift downriver, the bright yellow and orange floats on their nets creating an S on the fast-flowing current. Their boats are empty too.

He is saddened by the drastic decline in the Roanoke River herring fishery and blames man for its condition.

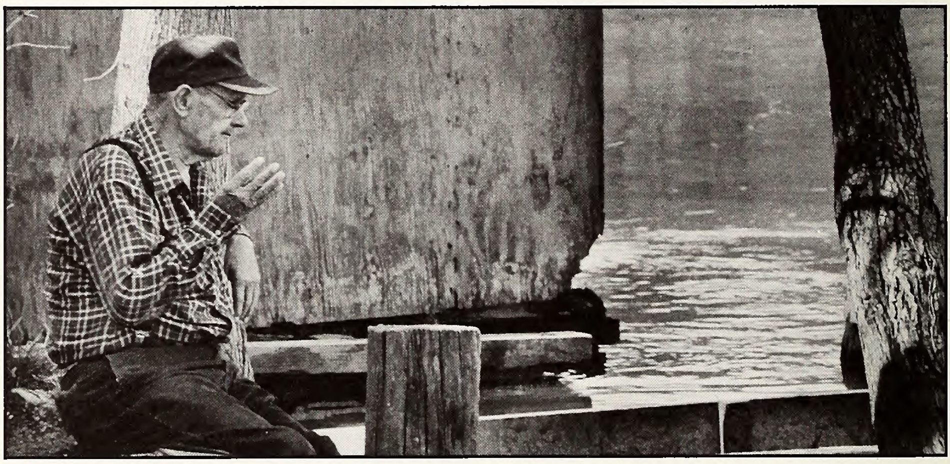
"If it keeps going like it is, there won't be no herring in seven, eight years," he says.

Amen, says Murray L. Nixon, a fisherman who's spent his life reaping the harvest of the Chowan, the Roanoke's sister river. In the wider, lazier Chowan, Nixon has set as many as 24 pound nets in a single season.

Pound-net fishing is labor intensive. One net requires hundreds of yards of mesh and more than 30 hand-cut, hand-trimmed poles to form the net's unique shape and keep it stationary in water.

So, poor harvests can be especially hard on the pound-net fishermen of the Chowan, Cashie and Middle rivers.

Other methods of catching herring—such as eel pots, fyke nets, hoop nets, trotlines and rod-and-reels—don't require as much work as pound nets, but fishermen using these methods also report hard times.



Hubert Williams

Photos by C.R. Edgerton

After a third drift downriver, Cox counts 14 fish for his morning's work and quits for the day. Seventy-seven-year-old Hubert Williams watches Cox place a cloth cover over his drift net and hook his boat to a trailer.

Williams has just eaten at the Cypress Grill, a restaurant that until a few years ago still had sawdust floors. It's difficult to distinguish the grill from the weathered fishing shacks that line the riverbank.

Folks from all over eastern North Carolina gather at the Cypress Grill in March and April to eat fresh herring cooked the traditional way: fried deep brown. It is only open during the herring run.

Williams wipes his mouth with the sleeve of his flannel shirt.

"We used to use dugout canoes and drift nets," Williams says of his days as a fisherman. "The current would be so strong, and we'd have to paddle against it to get back to the landing here."

The dugouts would be full of herring, he says. "And we didn't mind the hard work."

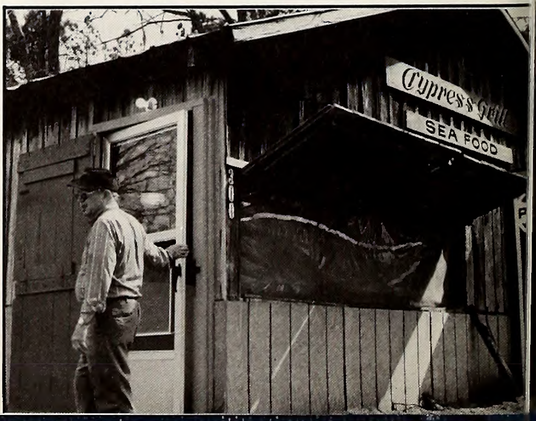
The Jamesville riverfront grays a little as the mid-afternoon sun falls behind tall gum trees on the bluff overlooking the Roanoke.

Guy Cox drives off with his boat in tow. The crowd at the Cypress Grill thins and Hubert Williams sits on the riverbank, twirling a twig in the calm water by his feet.

"It ain't like it used to be and won't ever be the same again," he says.

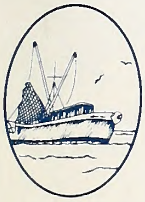
"You've got to leave some little ones before they can come back as grown ones. And that's something we just ain't doing." ■

The Cypress Grill at Jamesville



The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.



Come May 1, North Carolina shrimpers will have to TED-up.

It will be time for the fishermen to sew turtle excluder devices into the tailbags of their trawl nets.

Last year the federal government seesawed on enforcement of the TED regulations, and fishermen balked at using the devices designed to expel endangered sea turtles from shrimp nets.

Aside from resenting the government's intervention in the plying of their trade, fishermen declared that the devices lost the very catch they worked so hard to net—shrimp.

But Sea Grant agent Jim Bahen listened to shrimpers' complaints and along with netmaker Steve Parrish did something about them.

They made modifications in the two most popular TED designs—the Parrish TED and Georgia Jumper. By making the changes, the nets now do a better job of retaining shrimp.

To learn more about the modifications, send for Sea Grant's newest Blueprint, *Reducing Shrimp Loss Through Net Modifications in TEDs*. It will explain what the modifications are and how they work.

The Blueprint also provides test data from nine trawls in the shrimp grounds off the Georgia coast.

To receive a free copy, write UNC Sea Grant. Ask for UNC-SG-BP-90-1.

Joyce Taylor fed the multitudes.

The fare?

A helpin' of seafood information.

More than 800 people packed an auditorium at Elizabeth City State University during two sessions of the Pasquotank County Cooking School to hear Sea Grant's seafood education specialist Joyce Taylor.

Taylor, the featured speaker at the early April cooking school, extolled the attributes of fish and shellfish. And to prove her point, she cooked a few delectable dishes for sampling.

The cooking school is an annual event sponsored by the Pasquotank County Agricultural Extension Service and *The Daily Advance* in Elizabeth City.

Aquaculture is big business in North Carolina.

And Sea Grant researchers play key roles in making sure the business expands and becomes more efficient.

Some of these researchers are featured in the winter issue of *Research Perspectives*, a quarterly magazine published by the N.C. Agricultural Research Service at North Carolina State University.

In the magazine, Sea Grant's associate director Ron Hodson talks about his work with farm-raised hybrid striped bass and zoologist John Miller explains the intricacies of fish migration.

Tom Losordo, NCSU's extension aquaculture specialist, presents a close look at the water quality requirements of farm-pond aquaculture.

Other articles deal with the creation of artificial marshes and expansion of trout farming in North Carolina's mountains.

For a free copy of the winter issue and a free subscription to the magazine, write to *Research Perspectives*, Department of Agricultural Communications, Box 7603, NCSU, Raleigh, N.C. 27695-7603.

Crawdads used to be poor man's fare in the South.

Now folks are calling them crayfish and eating them in upscale restaurants in Cajun cuisine that's as "hot" as it tastes.

To meet the increased demand, some Tar Heel farmers are raising crayfish in their farm ponds. And with production of crayfish comes the inevitable processing of these cultured crustaceans.

That's why Sea Grant's seafood extension specialist David Green is teaching producers about processing and marketing.

Green arranged an afternoon workshop for the N.C. Crayfish Association in Greenville. If you would like more information about crayfish production or processing, contact Green at 919/726-7341.

Saltwater anglers, dust off your tackle boxes.

It's fishing tournament time.

The N.C. Division of Marine Fisheries has compiled a list of 39 saltwater fishing contests scheduled along the Tar Heel coast this year.

The tournaments will be sponsored by community and regional fishing clubs and most will take place between May and October. The only exception is the North Carolina Saltwater Fishing Tournament, which lasts all year and recognizes the top angler for each species.

The contests include several tag and release events, which are encouraged by the Division of Marine Fisheries as a means of helping conserve some species.

For more information on tournament entry requirements, contact the Division of Marine Fisheries in Morehead City. The number is 919/726-7021.

If you'd rather hone your angling skills without the pressures of a tournament, attend the North Carolina State University

Sport Fishing School.

The school, reported to be the oldest of its kind in the United States, will be held in two sessions: May 12–18 at Walker's Cay in the Bahamas and July 17–22 at Hatteras. Participants may attend either session.

The program emphasizes offshore angling and includes classroom instruction. The staff is made up of biologists, marine resource managers, tackle representatives, charter boat captains and university personnel.

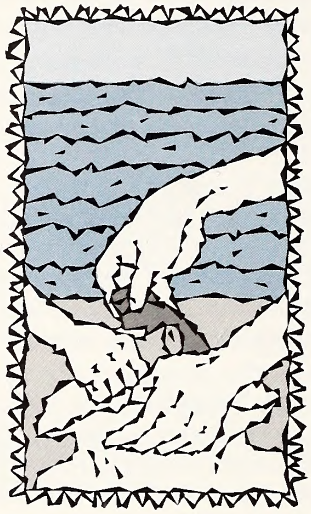
For more information contact Mac Currin, Department of Zoology, Box 7617, North Carolina State University, Raleigh, N.C. 27695-7617. Or, call Alice S. Warren, the fishing school's coordinator, at 919/737-2261.

If you've noticed a new name tagging the article about herring history, then you're an observant reader.

Carla Burgess is the newest writer to join the Sea Grant communications staff. She replaces Sarah Friday, who left the staff in December for *The News and Observer.*

Burgess, a graduate of North Carolina State University, worked for *The Laurens County Advertiser* in South Carolina and *The Sun-Journal* in New Bern.

She brings to the staff a background in news and feature writing.



Gear up for The Big Sweep, North Carolina's annual waterway cleanup, in an all-cotton T with a new colorful design for 1990.

The white T-shirt shows hands pitching in to sweep our shores free of litter. The design is trimmed in a bright border of teal, gold and rose.

To order, send $8 plus $1 postage and handling per shirt to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605. Postage and handling costs will be waived on orders of more than 10 shirts. Make checks payable to The Big Sweep.

The shirts are available in small, medium, large and extra-large. Be sure to specify the sizes and quantities.

Money from T-shirt sales will support The Big Sweep.

Get in the spirit and order now. And remember to mark your calendar for the Sept. 22 cleanup!

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Vol. 17, No. 4, April 1990. Dr. B.J. Copeland, director. Kathy Hart, editor. C.R. Edgerton and Carla B. Burgess, staff writers.

Coastwatch

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Seeking The Ocean's Natural Remedies

Harvesting the Shelves of Neptune's Pharmacy

BY KATHY HART

From Hawaii's rocky reefs to the pink sands of the Caribbean, scientists are turning to the sea to stock the pharmacies of the twenty-first century.

As they explore the Earth's final frontier, researchers are just beginning to probe the ocean and its biota for use in drugs, food additives, cosmetics, agriculture and other products.

Perhaps the ocean's greatest promise for the future, they believe, lies not in its role as the world's larder, but in its capacity to become the world's next pharmacy.

Our present pharmacy draws on terrestrial plants and herbs that have been dispensed for thousands of years.

Today's drugs are derived from land-based organisms or synthetic replicas. But the future for pharmaceuticals lies in one word: ocean.

And researchers will have a wealth of plants and animals to test. Almost 80 percent of all the Earth's organisms live in the sea.

Ocean submersibles equipped with robotics are making it possible for researchers to dive deeper and linger longer in Neptune's domain. They are harvesting algae, corals, marine worms, seaweeds, sponges and countless other plants and animals for testing.

And coming from the watery environment makes marine plants and animals different—better able to fight diseases and viruses.

Already scientists have discovered marine-derived drugs active against viruses, cancer and maybe even AIDS.

Only a few marine drugs are on the market now, but others are under development and consideration for approval by the Food and Drug Administration, says Richard Moore, director of the Natural Products Program at the University of Hawaii.

And Sea Grant scientists from Hawaii to Puerto Rico are playing a role in the development of marine pharmaceuticals.

In laboratories in Washington and Delaware, Sea Grant researchers took a byproduct of seafood processing—discarded crab, shrimp, crawfish and lobster shells destined for the dump—and turned them into materials fit for sutures and contact lenses.

Chitin (pronounced kite′ in), the glue mollusks use to build their shells, possesses unique healing powers. And when converted into chitosan, a simple derivative that is non-allergenic, non-toxic and biodegradable, it becomes the stuff medicines will be made of.

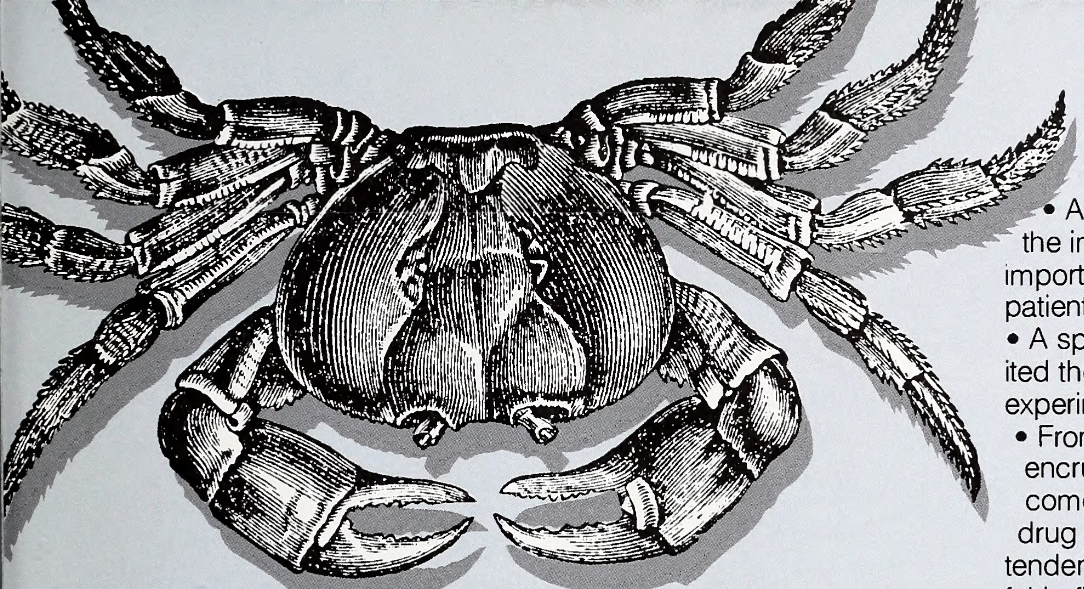
Chitosan can be woven into bandages and sutures that promote quicker healing of wounds and burns with reduced scar tissue. It is molded into contact lenses that are used as dressings for eye wounds and surgery scars.

For transplant victims, chitosan-made blood vessels could reduce rejection of the transplanted organs. For burn patients, a chitosan film forms an artificial skin that could speed recovery. And for folks suffering from athlete's foot, a chitosan ointment could spell relief.

All of these chitin products are in advanced stages of development and testing. And even more are on the way.

University of Washington scientists are studying the use of chitin to repair severed nerves. But chitosan's biggest promise for the future may lie in its ability to lower cholesterol.

Chitin carries a strong positive charge, which means it acts as an attractant. If ingested, it's possible chitosan could act as an absorbent carrier that removes cholesterol from the body.



It has already lowered cholesterol in animals without side effects. But General Mills, the company exploring chitosan's anti-cholesterol ability, has yet to test the derivative in humans.

But crab shell by-products aren't the only marine substances intriguing Sea Grant scientists. Delaware researchers are also delving into medical uses for mussel glue—a strong adhesive used by mussels and barnacles to attach themselves to rocks, piers and even each other.

This natural glue hardens and forms a strong adhesive bond in a watery environment that is not unlike the inside of the mouth, the eye or the human body.

A little dab of this non-toxic adhesive could revolutionize the way broken bones are set, eye surgery is performed and cavities are filled. Even soft body tissues and vital organs could be repaired with a drop or two of mussel glue.

But if arthritis is a nagging pain making you miserable, a sponge may offer comfort.

Hawaii Sea Grant scientists have isolated a substance called manoalide from a Pacific sponge. It promises to offer all the benefits of the commonly used anti-inflammatory drug hydrocortisone. But unlike hydrocortisone, it poses none of the side effects of steroids.

This anti-inflammatory snake oil presents a passel of medicinal uses: arthritis, auto-immune diseases, asthma, multiple sclerosis, therapy for organ transplants, skin diseases, attacks of poison oak or ivy, insect bites and, yes, snake bites.

An amino acid extracted from marine algae and bacteria by California Sea Grant scientists could aid in the diagnosis and treatment of nervous system disorders. And an acorn worm discovered in the deep waters off Maui by Hawaii researchers holds promise for treating tumors.

This exploration of the underwater pharmacy is not a lonely search. Researchers from marine institutes, pharmaceutical companies and national health organizations, such as the National Cancer Institute, are unlocking some pharmaceutical secrets, too.

Here are a few other noteworthy discoveries:

- An algae extract that stimulates the immune system could become important for AIDS and cancer patients.
- A sponge derivative has inhibited the AIDS virus in laboratory experiments.
- From a green slimy pancake that encrusts rocks and corals may come a new cancer drug. The drug also displays anti-viral tendencies that may make it useful in fighting yellow fever and herpes.
- Leukemia victims may see a cure in a marine coral.

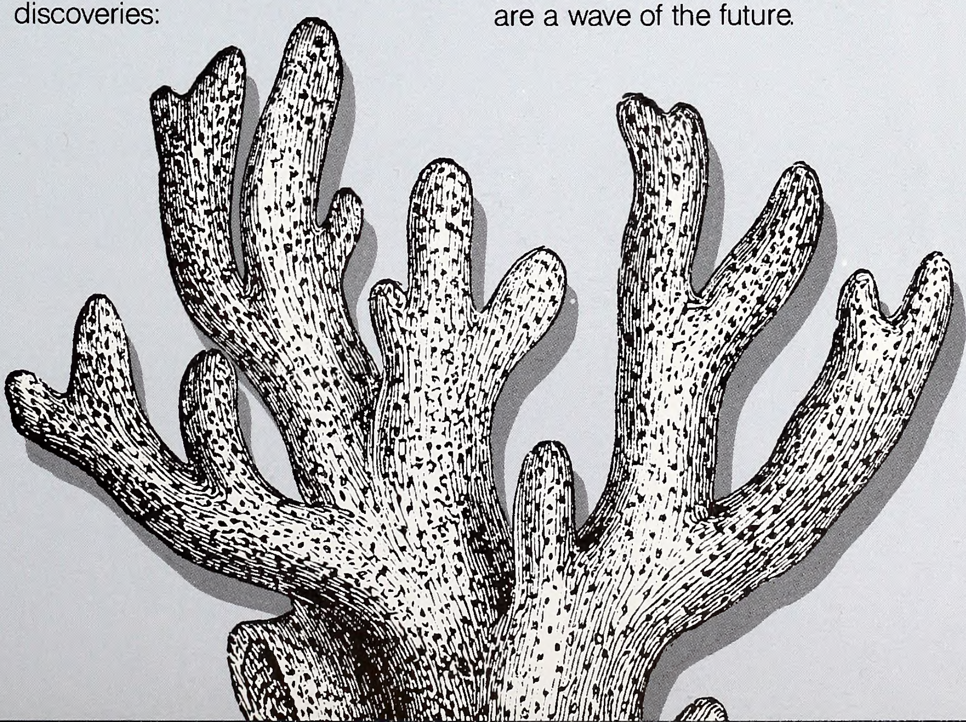
But the discovery of these marine drugs and their possible production raises the spectre of overharvesting, exploitation and possibly extinction of marine animals and plants.

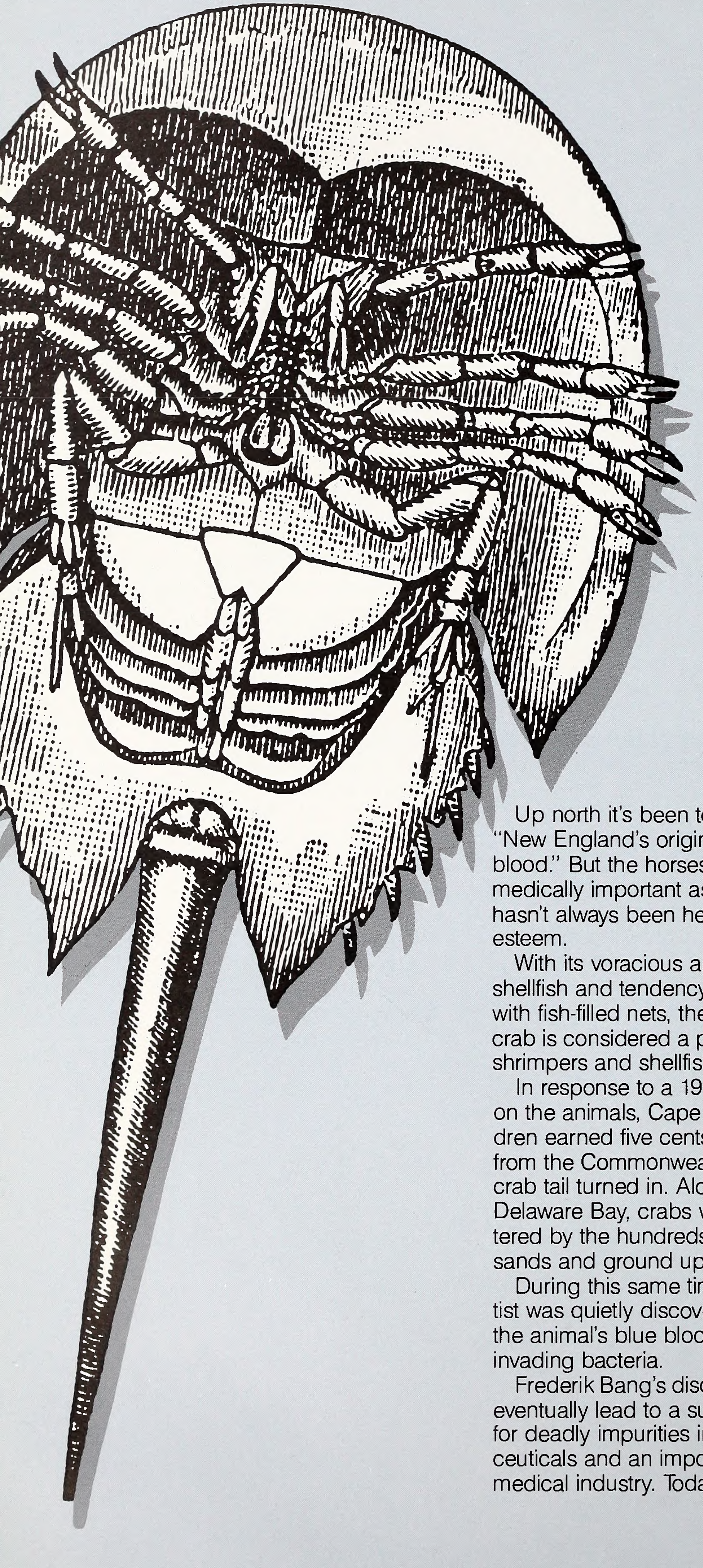
But this may not happen, says Moore, a Sea Grant scientist at the University of Hawaii.

Moore says that for now the ocean presents too many obstacles to make massive harvesting economically feasible. But, he says, other options are available.

Some organisms and plants could be cultured, creating a constant supply for production. Others could be chemically synthesized or engineered using biotechnology.

However they make it to the pharmacy shelves, marine drugs are a wave of the future.





Horseshoe Crabs Become Blue Blood Donors

BY CARLA BURGESS

Up north it's been touted as "New England's original blue blood." But the horseshoe crab—medically important as it is—hasn't always been held in royal esteem.

With its voracious appetite for shellfish and tendency to tangle with fish-filled nets, the horseshoe crab is considered a pest by many shrimpers and shellfishermen.

In response to a 1950s bounty on the animals, Cape Cod children earned five cents apiece from the Commonwealth for every crab tail turned in. Along the Delaware Bay, crabs were slaughtered by the hundreds of thousands and ground up for fertilizer.

During this same time, a scientist was quietly discovering how the animal's blue blood clots to kill invading bacteria.

Frederik Bang's discovery would eventually lead to a superior test for deadly impurities in pharmaceuticals and an important new medical industry. Today, no drugs leave a pharmaceutical company without this standard test.

Limulus amoebocyte lysate, the star of this industry, is a derivative of the horseshoe crab's blood, which can be extracted with no apparent harm to the animal.

"We take a sample of their blood, give them a little donut and a glass of orange juice and they go back in the water," Jim Finn says jokingly.

Finn, owner of Finn-Tech Industries Inc., bleeds 200 to 300 of the larger female crabs per week at the Delaware Bay laboratory.

The horseshoe crab is placed in a rack, flexed by the hinge joining its abdomen and head. A hypodermic needle is then inserted into the animal's heart chamber for the donation, which can comprise up to 30 percent of its blood.

The blood—bluish in color because of a copper-containing pigment that functions in respiration—

is centrifuged to separate the amoebocyte, or blood cell, from the plasma. The freeze-dried product of the cells is used in the lysate test.

"This is an in vitro test for fever-producing subtances that are found in drugs or devices," Finn says.

At more than $15,000 a quart, lysate is still more cost-efficient than its predecessor. It replaces the more cumbersome, expensive and less sensitive rabbit test, in which test solution was injected into the bloodstream of a live rabbit.

The animal was subsequently monitored for fever, shock or death. Drugs causing even a fever in rabbits were rejected.

The lysate test is a simple one, in which a small amount of the lysate reagent is mixed with an equal part of the solution to be tested. After about an hour of incubation at body temperature, the mixture is examined. A clot indicates the presence of bacteria.

The case of the tainted swine flu vaccine in 1976 apparently resolved the rabbit-versus-crab debate. The lysate test, the sole detector of the deadly endotoxins in some of the vaccine, emerged the victor.

Following that incident, the FDA provided guidelines for use of lysate in testing drugs, blood products, intravenous fluids and medical devices such as syringes.

In addition to these uses, research continues into lysate's clinical applications.

Lysate's use as a diagnostic tool for bacterial diseases has been limited by its inability to differentiate between species of bacterial toxins. This distinction is necessary for prescribing antibiotic therapy.

Still lysate has contributed to diagnoses of many diseases, including spinal meningitis, urinary tract infections and gonorrhea.

Carl Shuster, adjunct professor at the Virginia Institute of Marine Science and a pioneer of horseshoe crab research, is building a library about the animal at the school.

In evidence of the rapid research strides made since its introduction, Shuster says information on lysate work alone nearly equals that on the animal's history.

And when you talk horseshoe crabs, you're talking history. Hundreds of millions of years of it.

The earliest ancestor of the horseshoe crab, the aglaspids, swam the waters 500 million years ago.

The horseshoe crab is really not a crab at all. It's a member of the same phylum as crabs—arthropod—but is most closely related to spiders and scorpions.

The animal has three segments: the head and chest region, covered by a hard shell or exoskeleton; the abdomen, carrying its six pairs of appendages; and its spiny tail or telson, used for leverage.

The horseshoe crab's eyes are also medically important. Much of what we know about human vision has stemmed from research on the animal's large compound eyes and long optic nerve.

One must wonder about the animal's chance of survival amid the demand and virtual requirement for its blood.

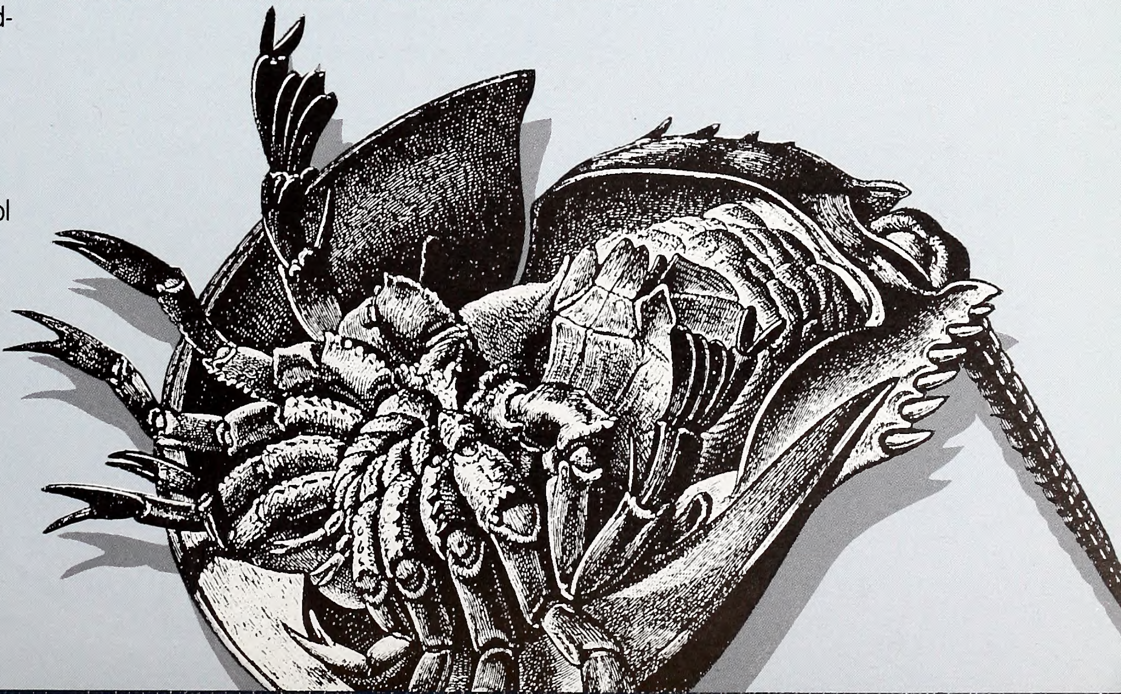
"There's no doubt we've got to start getting a serious handle on population dynamics," says Shuster, but he noted that laboratory bleeding is not to blame for high mortality. "The biggest impact is when they take them for fisheries, cutting them up for eel bait and conch bait."

Experts believe that laboratory bleeding does not significantly increase horseshoe crab mortality. And crabs can regain their blood volume in three to seven days, though it takes months to regenerate amoebocytes.

A study by Anne Rudloe in the early 1980s, in which 10,000 crabs were tagged and half were bled, revealed a 10 to 11 percent increase in mortality among bled crabs.

"Crabs have been found two years after being bled breeding on beaches," says Finn, who is involved in a tagging program with Shuster to learn more about the animal.

The horseshoe crab has coexisted all these years in a "soup" of aquatic bacteria and toxins. The reaction of its blood to invading bacteria suggests a sort of primitive immune system that has helped the animal—and mankind—to survive.



Sharks: Resisting Cancer Naturally

BY CARLA BURGESS

Just when you thought it was safe to go back in the laboratory . . . scientists are in there studying sharks and their potential value in cancer treatment.

The creatures appear to have a natural resistance to cancer.

"You just don't find sharks with disease, generally," says Carl Luer, a marine biochemist at Mote Marine Laboratory in Florida.

A good bit of his work there involves exposing sharks, skates and rays to potent chemical carcinogens.

"We haven't been able to produce anything to even look like the early stage of a tumor," Luer says.

Exposure during even the initial stages of the embryo, an especially vulnerable period, has failed to produce a tumor.

Jay Grimes, director of New Hampshire Sea Grant and a professor at the University of New Hampshire, has studied bacteria associated with shark tissue or cartilage.

"All tissue in healthy sharks, with the exception of blood, are heavily colonized by a variety of bacteria," he said. "But these bacteria do not cause disease in the shark.

"The bacteria is apparently living in a symbiotic relationship we don't understand yet," he says, noting the animal appears affected only in the case of undue stress.

Shark cartilage protein, Grimes explains, appears to have antineoplastic qualities, meaning it inhibits the growth of tumors.

Other research has shown that injections of the cartilage extract have dried up the blood vessels in cancerous tumors of laboratory rats.

This potential cancer treatment stems from scientists' attempts to inhibit the growth of blood vessels that feed tumors.

According to a Massachusetts Institute of Technology report, extract from calf cartilage also inhibits blood vessel growth. But for extensive experiments, it's hard to get enough extract from the bone-rich skeletons of mammals.

Shark skeletons, on the other hand, are all cartilage.

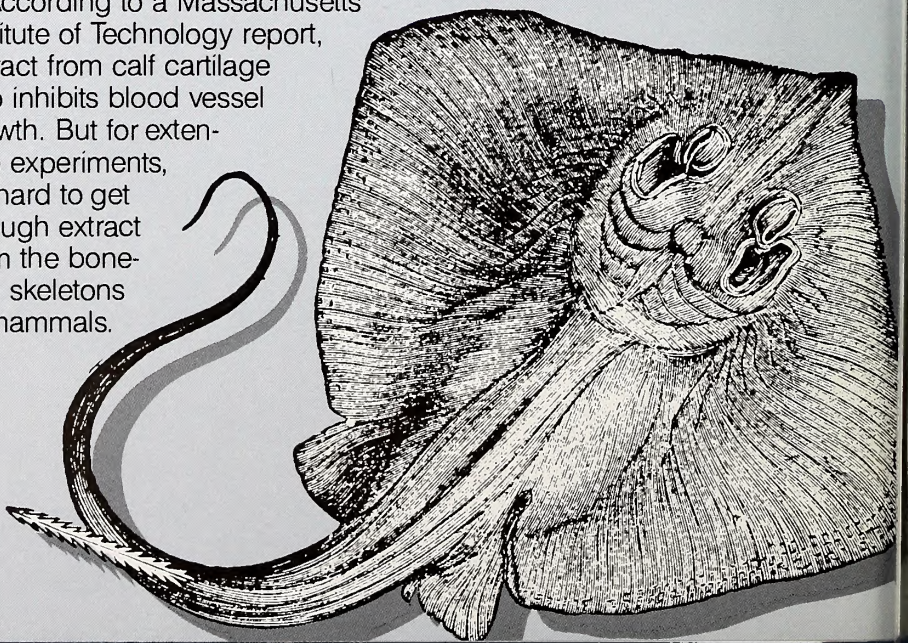
Apparently, the research on sharks and cancer is still in its formative stages.

"The hard part is to keep funded," says Luer.

He hopes various institutions can eventually work together to advance the research on shark cartilage protein.

Luer adds that a treatment, when all the bugs are worked out, should be synthesized.

"We're not looking to rape the environment of all sharks simply to produce this product," he says. "There just aren't enough sharks to support this kind of thing."



The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

Fisheries enforcement officials along the East Coast are clamping down on the soaking of sea scallops.

By immersing sea scallop meats in water for several hours, the edible abductor muscle inflates, says Sea Grant's seafood specialist David Green.

Why swell a sea scallop?

Northeast sea scallops have been overharvested, and the mollusks netted are often small. Too small, in fact, to meet the minimum harvest sizes imposed by the New England Fishery Management Council.

To dodge size limitations, some fishermen and processors are steeping the scallops to inflate their size. But the dunking is illegal in most East Coast states, including North Carolina.

A Massachusetts processor was shut down and 1,500 pounds of sea scallops were confiscated because the plant was handling soaked scallops. Enforcement officials with the N.C. Division of Marine Fisheries are also monitoring Tar Heel plants that frequently process sea scallops.

Green says processors and fishermen should be aware of the regulations about soaking.

But, he adds, the soaked mollusks do not pose any health risk to the public. The added water will only make the scallops splatter more in the frying pan.

If seafood specialist David Green has anything to do with it, crayfish will no longer be just a Louisiana commodity.

Green has been working with Pamlico County seafood processor Tom Caroon to develop a processing procedure for the Bayou crustacean.

He's worked out handling methods that will meet sanitation standards and processing time temperatures. With this information, Tom Thumb Seafood can now handle as much as 1,000 pounds of crayfish a day.

Handling crayfish may help crab processors extend their work season. Crayfish are harvested from mid-March until early June, but blue crab season doesn't peak until July.

And Green says that plants which are certified as crustacean plants by the N.C. Division of Shellfish Sanitation can process crayfish with their existing equipment and a few modifications.

Green has also been looking into canning and pickling the crustaceans.

For more information about processing crayfish, call Green at 919/726-7341.

Sea Grant's coastal engineer Spencer Rogers says prospective buyers of coastal property should disregard the safety scorecard issued for beach communities in April by a Duke University geologist.

He says the "best and worst" list of 25 coastal communities is oversimplified and could lead those shopping for coastal real estate to make unwise decisions.

The list, compiled by Orrin Pilkey Jr., a Duke University geologist, and Todd Miller, executive director of the N.C. Coastal Federation, ranked communities according to the natural characteristics, anticipated development and physical changes, quality of management and potential danger to people.

But Rogers says the rankings overgeneralize the safety of a site by comparing large sections of shoreline.

"You can't categorize a community or island by the level of risk on part of the island," Rogers says. "You have to be site specific."

According to Pilkey's scorecard, Brunswick County's Sunset Beach was rated the safest coastal community; North Topsail Shores in Onslow County, the riskiest.

Sunset Beach earned Pilkey's accolades because its beaches are accreting instead of eroding. But Rogers says that hasn't always been the case.

Sunset Beach has had periods when the island lost 25 feet of sand per year, he says. A new inlet was cut in the southwest end during Hurricane Hazel in 1954, and parts of the northeast end have been open water as recently as the late 1960s.

And Rogers questioned the reliability of Sunset Beach's floating bridge if storm evacuation became necessary.

In contrast, Rogers says some areas near the bridge at North Topsail Shores, the community rated as worst, have low erosion rates and good access to the mainland in case of evacuation.

"Some of the best sites at North Topsail Shores would be a far better choice for a home than a bad site at Sunset Beach," Rogers says.

And when it comes to evacuation, Ocracoke, the second "safest" community on Pilkey's list, can be hard to leave behind. Ocracoke is accessible by a ferry system that must shut down when winds exceed 35 to 40 knots.

The third slot on Pilkey's safety list was occupied by Nags Head—site of some of the worst erosion on the North Carolina coast in recent years, Rogers says.

Rogers and Pilkey agree that prospective coastal homeowners should fully realize the risk of buying property in one of nature's most dynamic, changeable systems. But Rogers believes buyers should look beyond communities to specific sites.

For more information about choosing coastal real estate, send for a copy of *Your Place at the Beach: A Guide to Buying Vacation Real Estate.* Ask for UNC-SG-87-04. The cost is $2.50.

If you have further questions, call Rogers at 919/458-5498. Or write P.O. Box 130, Kure Beach, N.C. 27889.

Coastwatch

Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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To help us specialize our services, please answer these questions.

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☐ Marine recreation
☐ Mass media
☐ Seafood processing/marketing
☐ State government
☐ University professor/researcher
☐ Other__________________
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Coastal property owner: ☐ yes ☐ no Boat owner ☐ yes ☐ no

$_________ contribution to defray printing costs for *Coastwatch*

Pass the word!

Big Sweep '90 is looking for zone captains to help coordinate the annual statewide cleanup September 22.

Zone captains help regional coordinators with publicity, recruiting volunteers and overseeing cleanup on the big day.

If your church, school, workplace or civic group would like to spearhead a group cleanup somewhere, let us know. This is one time when dropping a name is acceptable!

Call us at Sea Grant with your suggestions. Our number is 919/737-2454.

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Photo by C.R. Edgerton

North Carolina's Coastal Lakes

Mattamuskeet, Phelps, Pungo, Alligator.

North Carolina's coastal lakes are shrouded in mystery.

Each is unique. Each has its own set of outstanding ecological features. Each makes its own tattoo on the face of the Pamlico peninsula.

They have been known since man's earliest wanderings on the continent as places of beauty and abundance.

Yet, no one knows how they were formed. Scientists have their theories—meteor showers, glaciation, sink holes, wind and waves, peat burns—but none dare to say "this is the way they were made."

The four shallow lakes lie peacefully on the large wetland area west of Pamlico Sound, once one of the largest swamp forests in the world.

Each year they attract more and more people. In spring, anglers come in schools to battle their favorite fish. In fall and winter, bird lovers flock to see migratory waterbirds by the thousands.

This issue of Coastwatch *explores Lake Mattamuskeet and Lake Phelps—the largest of the state's natural coastal lakes.*

Mattamuskeet's Struggle to Maintain Quality

By C.R. Edgerton

Lake Mattamuskeet shines like a silver bowl on a table of swampy land.

From the first discovery of North Carolina's magnificent inland sea, people have hunted and fished here. They have also attempted to mold Mattamuskeet into something it was never meant to be.

But man's involvement on Lake Mattamuskeet has been only a moment in the lake's biological time line. Long before humans decided they'd control the heartbeat of the lake, millions of migratory birds called Mattamuskeet home during the fall and winter months.

That's the primary attraction of this lake for hundreds of people every year, says biologist Kelly Davis. With binoculars in hand, birders make annual treks to Mattamuskeet's peaty shores.

In earlier days, hunters swarmed the lake. Most would take home prizes that were all too easy to bag. Old photos show these men with ducks, geese, swans and other migratory birds strung around their shoulders.

Today, hunting on Mattamuskeet is strictly regulated by refuge officials. For two weeks in December, 360 people—chosen by lottery among thousands who apply—are allowed to hunt for two days each. And at Thanksgiving, the refuge sponsors a two-day hunt for youth.

"Other than that, hunting is prohibited on the lake," Davis says,

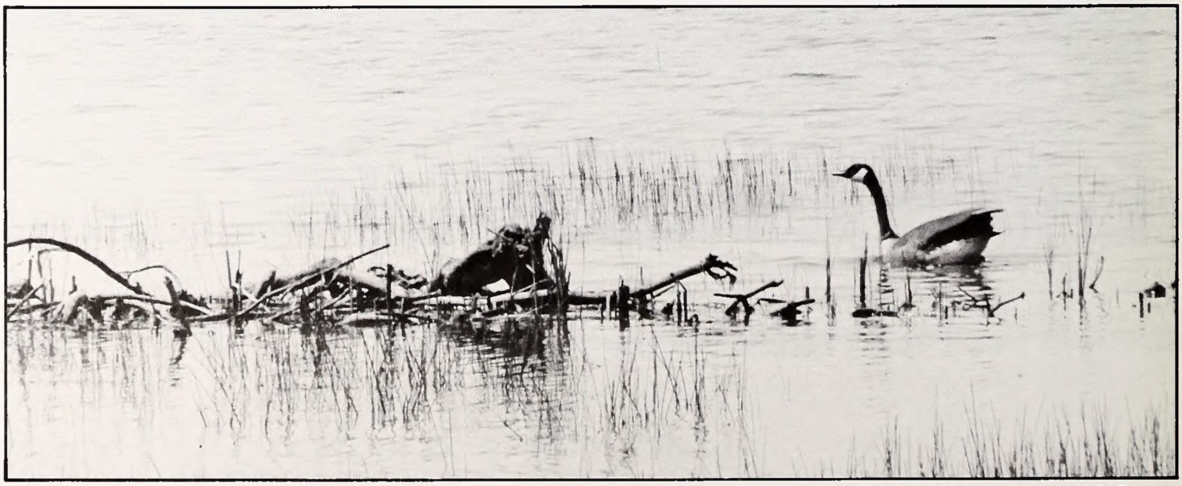
The birds have always been punctual. As the air cools and snow clouds begin to form, they follow their instincts and leave their homes in the far northern territories of the United States and Canada.

Mother Nature drops her barometric pressure and bends her easterly winds southward. This tail wind is the final cue. Millions of migratory birds begin their flight south.

As the feathered creatures wing their way toward warmer climes, they are driven by one major influence: a need for food. This food is found in abundance at Lake Mattamuskeet and the other coastal lakes, all of which lie directly under the Atlantic Flyway.

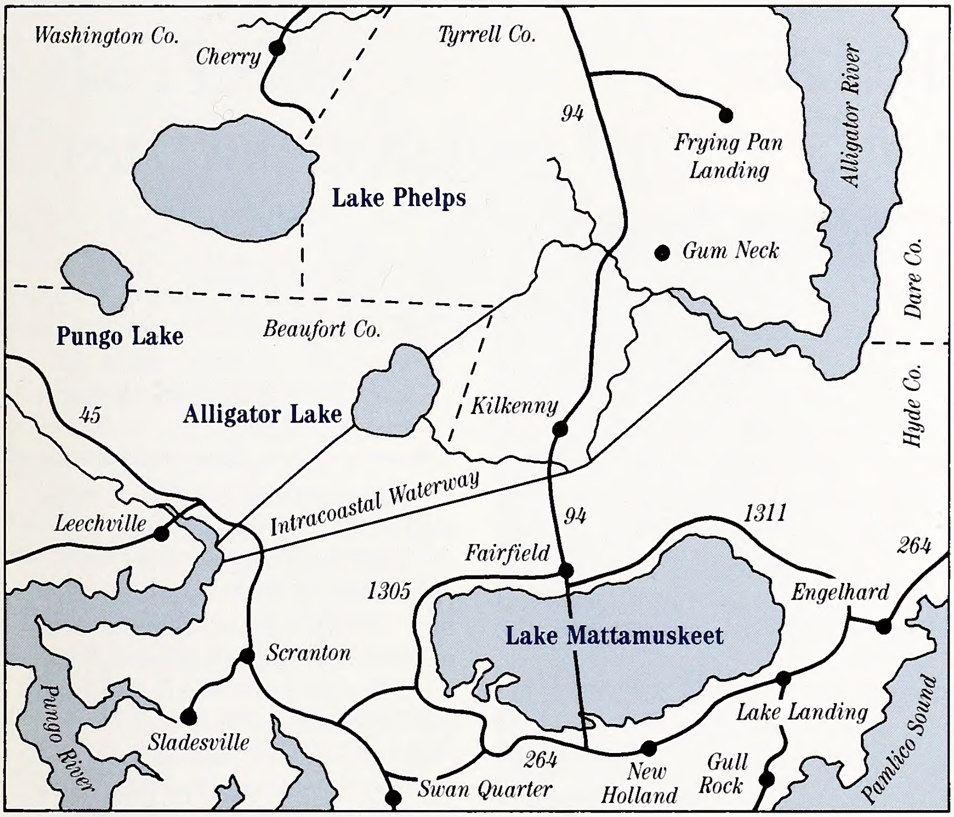
What kinds of birds seek the refuge of lakes Mattamuskeet, Pungo, Alligator and Phelps?

In the 1988-89 season, the skies



In the 1988-89 season, the skies over Mattamuskeet were clouded by 23,000 tundra swans, 17,000 Canada geese, 5,000 snow geese and 122,400 ducks (including canvasbacks, mallards, diving ducks, teals and widgeons).

Photo by C.R. Edgerton



over Mattamuskeet were clouded by 23,000 tundra swans, 17,000 Canada geese, 5,000 snow geese and 122,400 ducks (including canvasbacks, mallards, diving ducks, teals and widgeons).

They sought the lake's plentiful supply of redheadgrass, wild celery, southern naiad and muskgrasses. They also found refuge and food in the cattails and rushes that line the shores.

The bald eagle, a majestic bird whose Tar Heel populations dwindled to almost nothing during the decades of the 60s and 70s, is also a frequent winter guest.

In the 1940s and 50s, 40 to 75 eagles wintered at Mattamuskeet, but by the early 1980s only 3 to 5 were sighted. By 1984, the winter count had increased. Last year, 8 to 12 birds and at least four pairs were nesting in the eastern portions of the state.

Seeing that eagles might make a comeback on the lake, officials at the Mattamuskeet National Wildlife Refuge released 33 eaglets from 1983 to 1988. The survivors of this tiny brood are expected to make their presence known in just a few years.

Other birds of prey wintering at Mattamuskeet include the osprey and a variety of hawks.

The lake is unique in other ways. ''We have the largest aquatic vegetation resource in the state, and a very unique fishery,'' Davis says.

Anglers from many parts of the country make annual hook-and-line safaris to the lake to fish for largemouth bass, catfish, sunfish, perch and other freshwater species.

''But we also have some species—like striped bass, croaker, spot, flounder and crabs—that are more at home in salty or brackish waters,'' she says, attributing their presence in the lake to the series of canals that connects Mattamuskeet to the Pamlico Sound.

''The gates on those canals used to leak pretty much, allowing brackish water to filter through,'' Davis says. ''That's when the saltwater fish came in.''

The key to making sure Mattamuskeet's uniqueness is preserved for future generations lies in the quality of the lake's waters, Davis says. The U.S. Fish and Wildlife Service's extensive and ongoing water monitoring program for the lake and its canals and impoundments is a key element in assuring good water quality.

''We're constantly measuring the water quality and how it's linked to the vegetation in the lake,'' she says. ''We're concerned with the acidity of the lake because there's little buffering, little to make sure the acid level doesn't get too high to support the vegetation that the birds and fish feed on.''

The past infusions of salt water into the lake from Pamlico Sound once served as a buffer, reducing the amount of acidity in the lake. New gates on outflow canals essentially keep brackish water out.

Also, some of the rain that falls into the lake has a pH level of about 3.8 to 4.8, Davis says. ''That's on the acid side, and we think it's going to become more and more acid,'' she adds.

When the pH reaches a certain point, changes will occur in the lake's ecology. ''This will definitely affect the food chains,'' she says.

Davis and her co-workers are worried about the acid levels. But they aren't alarmed about runoff from the 26,000 acres of farmland that drain into the lake. The lake's water ''turns over'' often enough to filter out most of the pollution and other contaminants. ''It takes about seven months for the water to turn over,'' she says. ''And that's pretty good. We're getting new water all the time.''

Davis will continue to monitor the lake's water until 1993. By then she should be able to determine if the lake is going to reach a ''steady state of alkalinity.'' ''If not, then we'll have to devise a plan to re-alkaline the lake,'' she says.

She's optimistic. She thinks Lake Mattamuskeet will hold to its healthy trends. With good management, she says, the lake will continue to host desirable plants that provide food and cover for the unique fishery and the multitudes of wintering waterfowl. ●

Man's Impact on the Lake

By C.R. Edgerton

The Algonquin Indians called it Mattamuskeet—''Dry Dust''—but no one knows why.

There is nothing dry about Lake Mattamuskeet. At 40,000 acres, it's the largest natural lake in North Carolina.

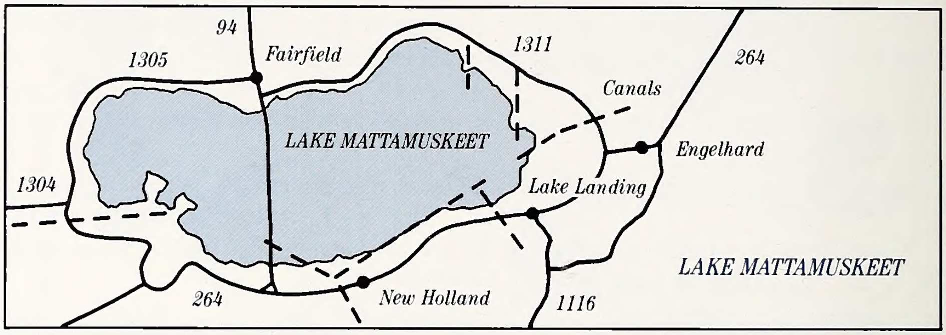
Perhaps it was so named by the Indians during a summer of drought, when peat-laden soil around the lake drained and became dry as a puff ball.

In any case, no Hyde County resident denies the economic and ecological importance of Lake Mattamuskeet. The lake's waters average two or three feet deep and teem with an abundance of fish. Its boundaries lie within the 55-year-old Lake Mattamuskeet National Wildlife Refuge.

''The ecological and economic value of this lake go hand in hand,'' says Kelly Davis, a U.S. Fish and Wildlife Service biologist at the refuge. ''Hyde County depends heavily on its natural resources, and here we have one of the richest resources around.''

Davis says about 50,000 people visit the lake each year—two thirds of them fish and crab in the lake's unique fishery and the others come to watch the thousands of waterfowl that winter there.

For more years than man has counted, this expanse of fresh water has been one of the major winter stopovers for thousands of migratory waterfowl traveling the Atlantic Flyway.



Swans, ducks, geese and other birds depend on the lake as a safe harbor from the rigors of winter and its accompanying lack of food. Though the numbers of these wintering birds have fluctuated over the years, Mattamuskeet is a regular pit stop.

Mattamuskeet hasn't always been a protected sanctuary. In the decade before the Civil War and the 20 years following 1914, the lake faced radical surgery from those who attempted to drain its waters and change its face for their own purposes.

Lake Mattamuskeet was originally a self-contained body of fresh water. No streams, creeks or rivers flowed in or out. Its pristine waters came from rain, runoff and ground water.

Then, in the mid-19th century, the men living near its shores had what they claimed was a brilliant idea: Let's drain the lake and use its fertile bottom for farming.

Slaves provided the labor to build the first of what would become a series of canals from Mattamuskeet to the Pamlico Sound. The canal stretched from Lake Landing on the south shore to Wysocking Bay on the Pamlico.

The work was difficult. Many problems arose and the farmers asked the state legislature for assistance. By 1911 the General Assembly had established a drainage district around the lake and authorized the sale of the lake bottom, which at that time was owned by the State Board of Education.

As many as four different companies purchased the lake bottom over the next decade, each one beginning with the same dream and each one encountering the same problems.

In 1925, The New Holland Company bought the lake bottom and, with the help of a pumping station that could handle 1.25 million gallons of water a day, managed to drain and farm 12,000 acres of the lake for three years. The company later fell prey to several problems—among them insects, low prices and excessive rainfall—and went belly up. The land was sold to the U.S. government in 1934 and the national wildlife refuge was formed.

The Civilian Conservation Corps turned the old pumping station into a lodge, which was used by the public until 1974. The lodge still stands on the lake's southern shore and is widely known as a landmark and a symbol of the era in which man attempted to harness natural forces beyond his control. ●

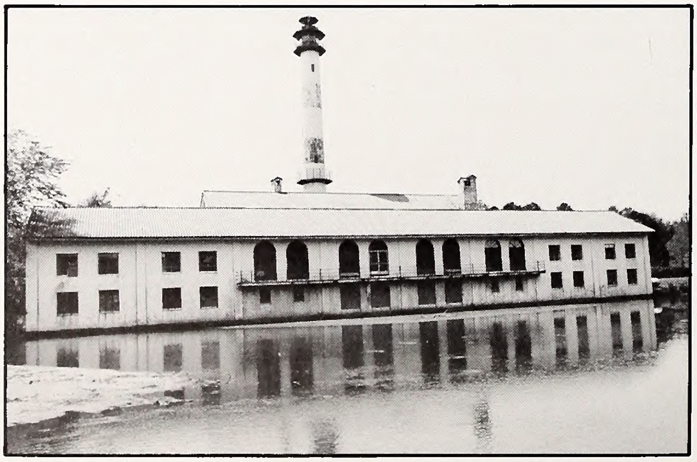


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Photo by C.R. Edgerton

Lake Phelps: Clear Waters Reflect Unique Environment

By C.R. Edgerton

A light rain filters through the thick canopy of cypress, sweetgum and poplar trees 135 feet above Sid Shearin's head.

His nylon coat is wet, his cap droops and a slight chill in the air makes for a little discomfort. But he doesn't seem to mind.

This is ''his special place,'' a haven from the rest of the world where it's not unusual to see a cypress tree as thick as the height of an average man. Most of the trees in this virgin forest were here before the first white man ever set foot in the New World. For centuries they towered over Algonquin Indians as they built villages and carved dugout canoes.

''I'm a tree man myself,'' says Shearin, who for the last seven years has been superintendent of Pettigrew State Park in Washington County. ''I love it out here. I never grow tired of walking down this path, looking at the trees.''

This day, he treads carefully on the half-mile trek to Moccasin Overlook, a wooden boardwalk recently constructed to give park visitors access through a swampy area of the park they wouldn't otherwise visit.

He and his two companions dodge puddles of mud and peat and soak in not only the rain, but the beauty of one of the last remnants of the state's once-vast swamp forests.

But this Eden isn't the central feature of Pettigrew, North Carolina's largest state park. Lake Phelps dominates. Discovered in 1755, its 16,600 acres of crystal clear waters form what Shearin calls one of the best-kept secrets of the state's park system.

Like its sister lakes—Mattamuskeet, Pungo and Alligator (or New)—the origin of Lake Phelps is lost in the unknown.

Photo by C.R. Edgerton

Sid Shearin treads carefully on Moccasin Overlook, a wooden boardwalk recently constructed to give park visitors access through a swampy area of the park they wouldn't otherwise visit.

''Some folks say the lakes are the footprints of Paul Bunyan, but that can't be true,'' Shearin says, laughing. ''Paul Bunyan never came this far south.''

There is no consensus as to how these lakes were formed, but the latest scientific research points away from outlandish theories of the past—meteorites, sink holes—and toward a more logical hypothesis, such as glaciation or the wind and wave actions of ancient receding seas.

''The North Carolina bays could have had multiple origins,'' says James K. Holley, a geologist with Applied Environmental Services in Raleigh whose recent Master's thesis dealt with the lake's hydrogeology.

''They could have formed from old peat burns or they could have been the remnants of old river channels. In any case, there's no real consensus.''

Holley's recent findings—based on radiocarbon dating—have placed the ages of lakes Phelps and Mattamuskeet at more than 38,000 years.

''That means the lakes have been around a lot longer than man has been living on them,'' he says. ''And all that time, Lake Phelps has been shifting, migrating northward.''

That migration can be proven by a series of ancient rims discovered on the south shore, Holley says. Core samples have indicated that over the centuries the lake moved, creating new shorelines.

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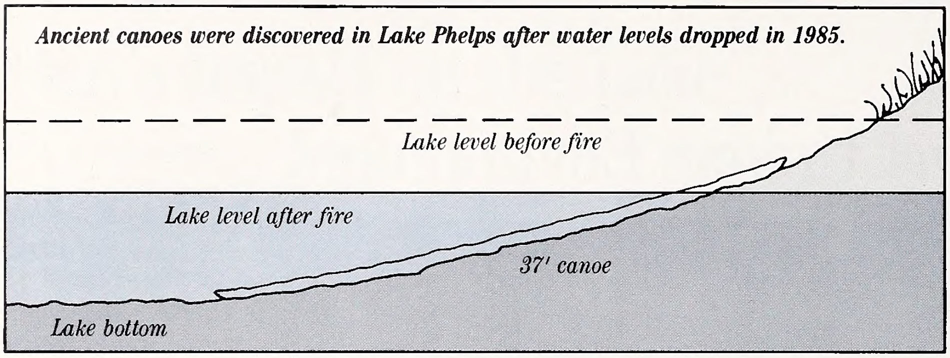

Ancient canoes were discovered in Lake Phelps after water levels dropped in 1985.

"This means the lake is shifting or was once larger than it is now," he says.

But theories about the beginnings of Lake Phelps cannot explain other things that make this lake and its environs one of the most unique biological areas in the state.

"It's amazing," says Shearin. "Largemouth bass flourish in this lake, but they're not supposd to. They supposedly can't reproduce in water with a pH below 6.0. But here, the water is about 4.6 pH. We don't know why they live here."

Then there's the Waccamaw Killifish, a tiny fish that's found in Lake Phelps—and further inland in Lake Waccamaw—and nowhere else in the world.

"How do you explain something like that?" Shearin says. "Here are two disjunct populations of a particular fish and no one knows how this happened."

The most unusual thing about Lake Phelps, and the feature that has given the lake lots of publicity in recent years, is the lake's ability to preserve wood.

Since 1985, about 30 ancient dugout Indian canoes have been found in the lake's sandy bottom. These canoes range in age from 550 to more than 4,350 years old.

"We started finding the canoes around 1985, after a fire occurred in the summer of 1984 on the south side of the lake," Shearin says. The fire burned 95,000 acres of timber, and fire fighters pumped millions of gallons of water from Lake Phelps in efforts to control it.

"The water level in the lake went down about eight inches," Shearin says. "That's when the canoes started showing up."

David Phelps, an archaeologist at East Carolina University, notes that the first canoes, as well as hundreds of other Indian artifacts, were discovered by fishermen. Most of the items were seen clearly through the lake's clear, shallow waters.

In a brochure published last year, Phelps estimated that artifacts spanning 11,000 years have been collected by fishermen and archaeologists. He says the 30 Lake Phelps canoes are "the largest number of canoes in the Southeastern United States still in association with the sites where they were manufactured or used."

Shearin says the longest canoe measures about 37 feet, making it the longest dugout canoe discovered in the South. Nineteen of the canoes have been radiocarbon dated and 16 of them are more than 1,500 years old, he says.

But why the large number of canoes and how could they have been preserved over centuries, some even longer than the Great Pyramid of Giza in Egypt?

"This is another area that has caused some speculation, but no real answers," Shearin says. "The canoes are made of cypress, which has a natural tendency to resist decay and they have been under sediments on the lake bottom, which prevents oxygen from reaching them."

Another reason for the canoes' longevity might be found in the makeup of the water in the lake, which is unpolluted and slightly acid.

"Everything drains away from the lake, nothing drains into it," Shearin says. "This means the water is mostly rainfall, and therefore very clean. There's no pollution in it."

Shearin says the algae and other microscopic plants and animals that would literally "eat up" a wooden canoe in normal freshwater lakes and ponds are not present in Lake Phelps. "This is another thing we can't explain, but these organisms just aren't there," he says.

Though no one has surveyed the water quality of Lake Phelps, recent events may lead to more stringent controls of the lake's waters, Shearin says.

"We're real picky about our water here," he says. "We're getting more fishing here on the lake every year. The fishermen are discovering Lake Phelps because of polluted water elsewhere."

Hopefully, Shearin notes, the influx of more fishermen will not spell doom for the lake's excellent water. "We want to remain one of the best fishing lakes in the state," he says.

James Holley believes Shearin's wishes for Lake Phelps can be realized if management of the land in and around the park stays within the public's jurisdiction.

"One has to consider the possibilities of development around the lake, and some of that is already occurring," Holley says. "But the best bet for the lake is public management. We'd do a lot better that way. If it's done privately, the land and the lake would most likely be exploited." ●

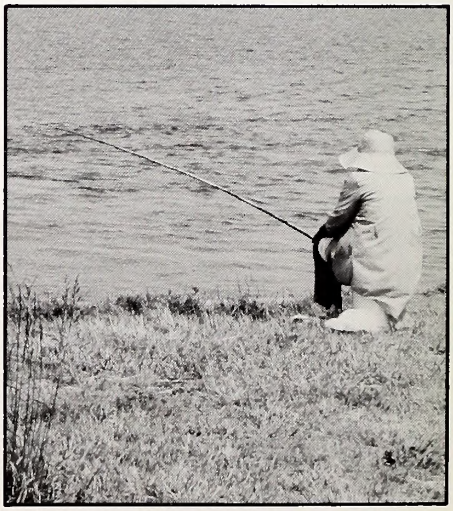

Photo by C.R. Edgerton

The Back Page

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Blue crabs may not be just summer pickins' any more.

David Green, Sea Grant's seafood specialist, has received a grant from the National Coastal Resources Research and Development Institute to test methods for extending the availability of blue crab meat.

Green says that during peak supply months when prices are low and pickers are overworked, crab houses could steam cook, flash freeze and store crab body cores. Then when prices rise and pickers are out of fresh product, the cores could be thawed and the meat picked.

Technology has already been developed for such a storage process, Green says. But it hasn't been used by the blue crab industry.

Green hopes to change that.

He plans to develop processing specifications that will yield thawed crab meat that is bacteriologically safe and tastes good.

Scientists already know that crab meat can be stored at minus 20 F for up to eight months with no change in texture or taste. Yet, Green wants to test the procedure on a commercial scale and use a taste panel and instrumental analysis to test the thawed product.

But all of Green's work won't involve steamers and freezers. He'll also be punching numbers into a calculator to reach an economic bottom line for storing the crab meat. To assist with the economic analysis, Green will call on Florida Sea Grant economist Chuck Adams of the University of Florida Department of Food and Resource Economics.

Flash freezing could offer crab processors several benefits, Green says. It could stabilize supplies of crab meat to hand-picking houses. Processors could offer pickers a more secure work environment, which should attract better workers. And processors would have better inventory control.

For consumers, it would extend the availability of hand-picked crab meat beyond summer months and offer a more consistent supply of quality product.

When all the costs and benefits are calculated, Green hopes to convince processors that flash freezing crabs is a viable, profitable way to do business.

Sea Grant sleuth Bob Hines is heading south to investigate a new shrimp net that has caught on in Louisiana.

The net is called a skimmer trawl, and it's a cross between a butterfly net and a Vietnamese chopstick rig, says Hines, a Sea Grant Marine Advisory Service fisheries agent. The net is rigged so that the boat pushes the trawl instead of pulling it as with conventional shrimp rigs.

The net has several attributes that led the Gulf and South Atlantic Fisheries Development Foundation to fund Hines' investigation.

First and foremost, it may eliminate the need for turtle excluder devices, or TEDs, a contraption disliked by most shrimpers.

The way the net is rigged, the tailbag is fished near the stern of the boat. This allows fishermen to pull it in every 20 minutes without stopping the boat. Any ensnared sea turtle could easily survive a 20-minute tow before being released after the net is hauled back.

Likewise, the frequent haul backs should also increase the likelihood that bycatch could be returned to the water alive.

The skimmer has even more merits. It improves the quality of the catch, snares less debris, uses less fuel and increases maneuverability.

And to top it all off, Bayou shrimpers claim 16-foot skimmer nets can outfish 50-foot conventional trawls.

With such an impressive list of attributes, Hines wants to see for himself the skimmer net in action. And he's taking along Carteret County fisherman Marion Lewis and East Carteret County High School marine vocational instructor John Weeks to aid in the investigation.

If the skimmer net works like Louisiana fishermen say, Hines wants to bring one back for testing in Tar Heel waters.

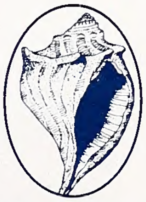
Spencer Rogers figures that the Dutch know that it takes more than a finger in a dike to hold back the ocean. In fact, Holland's ability to stay afloat rests squarely on the erosion and water-control techniques developed by its coastal engineers.

Rogers, Sea Grant's coastal engineer, hopes to pick up a few Dutch pointers during an international coastal engineering conference being held in Holland in late June.

But the learning will not be one-sided. Rogers plans to tell his international audience how folks on this side of the Atlantic design coastal buildings to withstand storm surge and wave damage.

Dikes and windmills aren't the only items on Rogers' June agenda. Capitol Hill also occupies a space on his calendar.

Rogers is slated to present Congressional testimony on proposed amendments to the Federal Flood Insurance Program. He will speak before a subcommittee of the U.S. Congress June 20.



No beach trip is complete without a shell collection.

It seems we're all compelled to pick up a few of these beach beauties and take them home as reminders of our summer vacation.

But why not do more than just let your collection gather dust. Identify these beach baubles and learn more about them.

It's easy with the Sea Grant booklet, *Seashells Common to North Carolina*. Using the photographs and drawings pictured in the booklet, folks can determine a shell's common and scientific name and learn about its range and habitat.

For a copy of this 36-page illustrated guide to more than 100 of the state's shells, write UNC Sea Grant. Ask for UNC-SG-72-09. The cost is $2.

Many people agree: North Carolina's coastal waters are in trouble.

Rivers, streams and sounds are choked and poisoned by the residues of man's progress.

But there's hope. Through several media outlets, people are learning about the problems facing the state's coastal waters. WRAL-TV's latest documentary, "Troubled Rivers," and Glenn Lawson's new book, *Troubled Waters*, are two of the most recent offerings.

"Troubled Rivers" examines the Neuse River, a major North Carolina waterway that receives many pollutants during its long journey to the Pamlico Sound.

A videotape version of "Troubled Rivers" is available for teachers. The tape can be borrowed from WRAL at no charge or purchased for $10. Contact Phyllis Parrish at 919/821-8646.

Like the WRAL video, Glenn Lawson's book takes a look at North Carolina's coastal waters and reports the feelings and fears of the people who work and play there.

For copies of the book, send $10.45 to Hadnot Creek Publishing Company, 3223-5 Highway 58, Swansboro, N.C. 28584.

***Coastwatch* is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.**

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Much Ado About Bycatch

Photo by C.R. Edgerton

Bycatch Stirs Controversy

BY KATHY HART

Fishermen call it trash fish; fisheries resource managers, bycatch. But environmentalists and sport fishermen say it's robbery.

Whatever the name, the incidental catch that commercial fishermen net along with their intended catch looms as the issue of the 90s.

Fishermen are right. Sometimes the bycatch is a trashy mixture of jellyfish, hog chokers, tongue fish, spider crabs, sponges and urchins—sea creatures only favored as fare by sea gulls.

But more often than not, mixed in among unwanteds are juvenile and adult spot, croaker, mackerel, flounder, trout and blue crabs. These youngsters represent the potential catch of tomorrow.

And try as they might, commercial fishermen cannot cull their catch fast enough to return many, if any, of these desirables to the water alive.

It is the death of these juvenile finfish and shellfish that has sport fishermen and environmentalists calling commercial fishermen to task.

"We haven't taken a vote on it as a club, but most members are upset by the amount of bycatch," says Bo Nowell, president of the Raleigh Saltwater Sportfishing Club.

"It's an emotional issue," he says. "It's like seeing a recreational fisherman fill up his boat or cooler with more fish than his family can possibly eat or toss his catch on the beach to die. That's obscene.

"Recreational fishermen feel the same way when they see pictures with pounds of bycatch dead. They start to count how many pounds of bycatch there are by how many fishermen there are fishing on a daily basis. They get pretty upset," Nowell says.

But Nowell hastens to add that commercial fishermen and their bycatch aren't entirely to blame for recent declines in fish stocks. He realizes that factors such as water quality, habitat and Mother Nature play roles in the number of fish that swim our waters.

"We're not running around with spears trying to put trawlers out of business," Nowell says.

But nonetheless, Tar Heel commercial fishermen feel that sport anglers, environmentalists and the federal government are making a mountain out of a mole hill of bycatch.

"People simply have a misconception about bycatch," says Clinton Willis, a shrimper and president of the Carteret County Waterman's Association. "We just don't catch as much bycatch as they think. We don't see any problem.

"Besides, any bycatch goes back to the green box (the sound) to feed the crabs and bottom-feeding fish," he says. "It's being utilized."

Jerry Schill, executive director of the N.C. Fisheries Association, agrees. Some of the bycatch, he says, is kept as "legal food fish or bait fish for recreational and commercial fishing."

Willis says he sees no evidence of bycatch affecting finfish populations.

The summers of plentiful shrimp and heavy shrimping are always followed by heavy finfish catches in the fall, he claims. If bycatch were reducing finfish

Shrimp boats docked at St. Simons Island, Ga.

Photo by C.R. Edgerton

populations, then a good shrimp season should be followed by poor catches of fall finfish, he concludes.

But he says that's not the case.

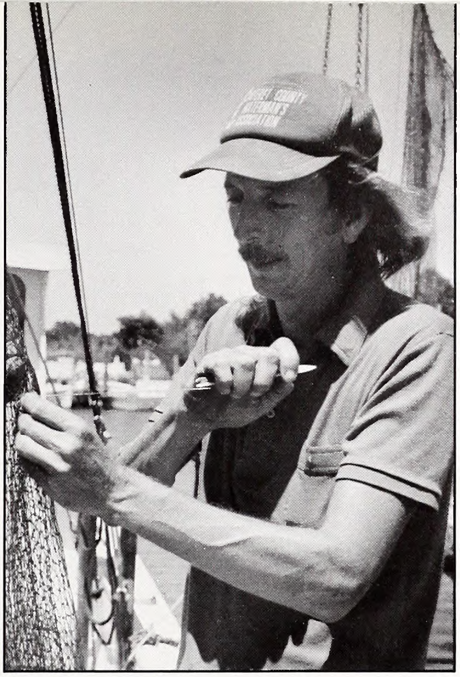
Carroll Yeomans of Vandemere concurs.

After more than 32 years of shrimping, Yeomans says bycatch is cyclical. "Some years, you could hardly work for the bycatch," he says. "The next year you wouldn't catch any."

And Willis and Schill say bycatch shouldn't become a scapegoat for fish and shellfish declines. Factors such as poor water quality and habitat degradation should figure into declines too.

"It's always easier to point a finger at the commercial fishing industry," Schill says.

"A recreational fisherman doesn't catch his normal amount of flounder or speckled trout, and he looks up from his boat and sees a trawler in the distance," he says. "He immediately assumes the problem is that damn trawler or net. He doesn't stop to think about habitat degradation and water quality degradation."



Clinton Willis

Photo by Jim Strickland

But Schill concedes that bycatch is a problem facing the commercial fishing industry, shrimpers in particular, because the public perceives it as one.

"We owe it to the resource and to the health of our own industry to address the problem," Schill says.

Already the bycatch of red snapper by Gulf shrimpers has flamed a debate between commercial and sport fishermen that is heated and volatile.

Fresh from the fight against the use of turtle excluder devices (TEDs), commercial fishermen are leery of government intervention and forced regulations on bycatch.

Willis says watermen can take care of the problem without regulation. When bycatch is thick, fishermen move to another trawling location or cut a hole in the tailbag of their net to release the bycatch.

But Schill believes fishermen should work with Sea Grant and the N.C. Division of Marine Fisheries to develop bycatch separation devices and solve the problem on a local level.

"We need to work with the management people—the federal agencies, the state fisheries managers, the bureaucrats—to work out this problem," Schill says. "If we don't work it out adequately, it will go to Washington. We don't need this issue there, and it shouldn't be there.

"Those folks have no idea what goes on out here on the water," he says. "So we need to take the bull by the horns and solve this among ourselves."

Yeomans and Willis think fishermen would be willing to give a finfish separator device a try.

"If someone comes up with a way to get rid of bycatch, I think fishermen would use it as long as it didn't kill the industry by reducing shrimp catch too," Yeomans says.

Sea Grant Test Trawls Reduce Bycatch

BY C. R. EDGERTON

North Carolina Sea Grant is catching up with bycatch.

The fisheries issue of the 1990s is being probed, tested and evaluated by a team of Sea Grant researchers who say they've made big strides toward reducing the number of juvenile finfish caught in shrimp nets.

That's good news for environmentalists and recreational fishermen concerned with reduced fisheries. And it's encouraging to shrimpers who don't look favorably on the time and effort it takes to cull finfish and other marine creatures from their shrimp catch.

The best news of all is that Sea Grant's recent testing of finfish separating devices (FSDs) showed no significant loss in the numbers of shrimp harvested.

"Our results are preliminary, but we're pleased with what we've found out so far," says Jim Murray, Sea Grant's Marine Advisory Service director and principal investigator in the bycatch project.

"We've tested three basic net designs, and in most cases, those nets have shown a significant decrease in finfish without a noticeable loss of shrimp," Murray says. "The results have been good."

Murray emphasizes that Sea Grant's research, which is being funded by the National Marine Fisheries Services and the National Undersea Research Center, is still in its infancy. But, he says, "We know that FSDs work, they reduce bycatch."

And B.J. Copeland, director of UNC Sea Grant, says the project is providing early answers to an issue that's just simmering now, but could boil over soon.

"We recognized the importance of the issue early on. We've done the research and have applied it practically under true-to-life conditions," says Copeland.

Sea Grant's bycatch project began earlier this year when Marine Advisory Service agent Jim Bahen began to interview fishermen up and down the North Carolina coast. He questioned them about possible designs for bycatch-reducing trawls.

When federal fisheries officials began design work on turtle excluder devices (TEDs) a couple of years ago, local fishermen complained that they were left out of the process. "We didn't want that mistake repeated with FSDs," Bahen says.

Several good ideas were garnered from the fishermen. Shortly, three new trawl designs incorporating these ideas were in the works. Assisting was Steve Parrish of S&S Net Shop in Holden's Beach. Parrish is the designer of the Parrish "soft" TED.

After a few kinks were worked out of the original FSD designs, scale models were constructed and transported to the David Taylor Naval Research Center in Bethesda, Md. The nets were lowered into a large tank of circulating water and dye tests were done to determine water flow dynamics.

Using the results from the flume tank tests, Bahen and Parrish made improvements in the net designs and full-scale models were constructed.

In June, FSD designs were installed in standard shrimp trawls and were towed off the coast of St. Simons Island, Ga., aboard the *Georgia Bulldog,* Georgia Sea Grant's research vessel. The *Bulldog* is a fully-rigged 72-foot shrimp trawler.

"We wanted to fish these nets out in the field, right among the fleet," Bahen says. "We felt there was no better way to see if bycatch could be reduced than by actually catching shrimp with our nets."

The key to these experiments, Bahen says, was towing the FSD-equipped nets alongside a standard shrimp trawl that had not been modified for bycatch reduction or TED use.

"We knew if we compared the biomass of the FSD nets with the non-FSD nets, we could come up with a good idea of how the test nets were working," he says.

Three designs were tested.

In one design, a large-square mesh was sewn in an extension that also included a funnel-shaped accelerator.

Another used the same design, but diamond-shaped holes were cut in the extension near the accelerator funnel.

The third was a Parrish TED redesigned to include escape panels for finfish.

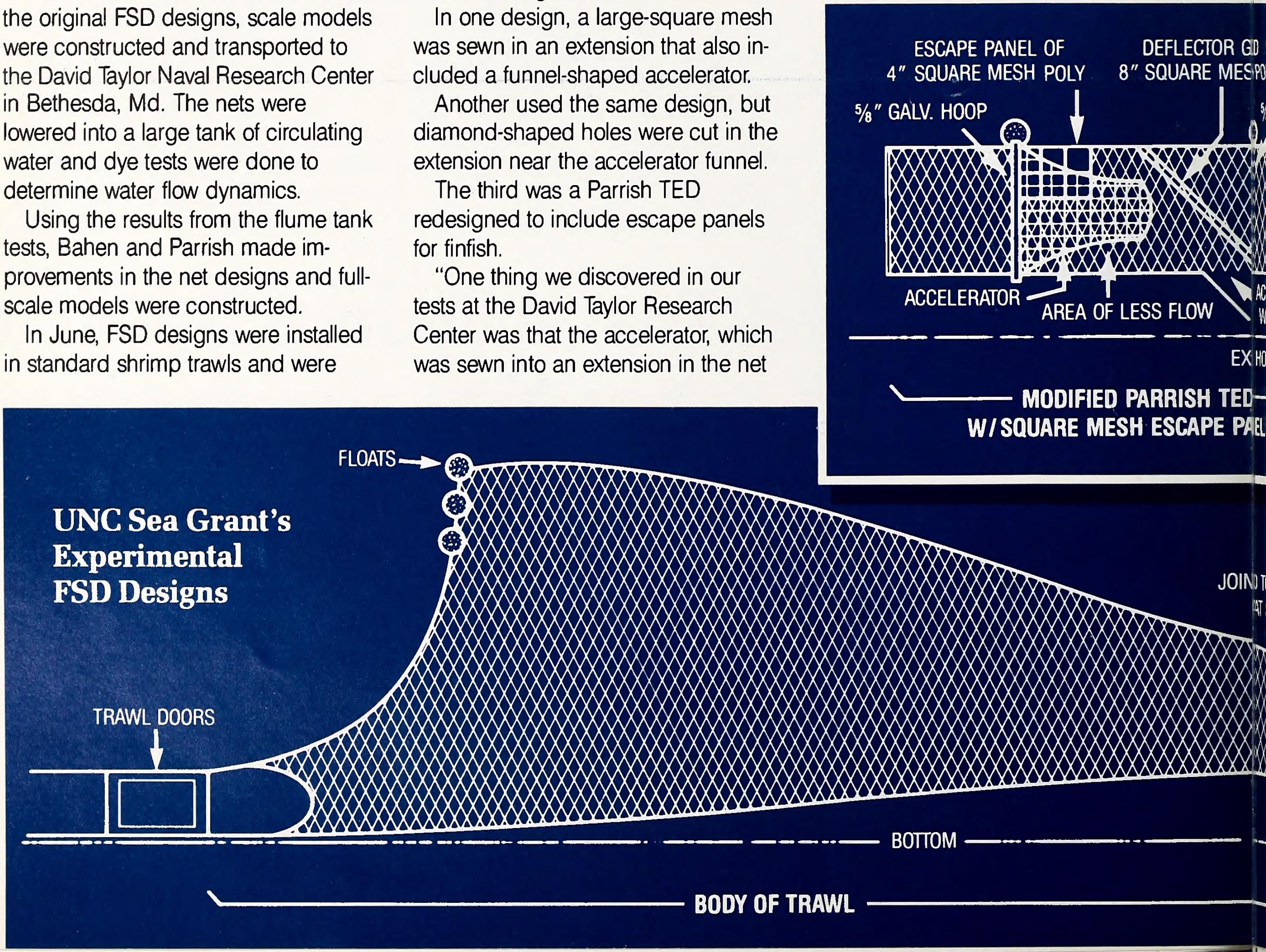
"One thing we discovered in our tests at the David Taylor Research Center was that the accelerator, which was sewn into an extension in the net just before the tailbag, increased water flow to the tailbag while creating calmer water around the outside of the funnel," Bahen says.

The resulting flow dynamics proved that the weaker and slower-swimming shrimp could be forced into the tailbag by water flowing through the accelerator while the stronger swimming creatures such as finfish could seek the area of quiet or calmer water.

"So, we located the larger mesh and the diamond-shaped holes in the portion of the net where we felt the fish would congregate, in the dead-water section," Bahen says.

Those innovations proved favorable in the field tests, says Roger Rulifson, an East Carolina University fish biologist.

The nets (the FSDs and the standard trawls) were tested in 90-minute trawls



Bahen (left) and Parrish adjust a video camera in the cod end section of the diamond-mesh FSD aboard the *Bulldog*.

Photo by C.R. Edgerton

for five days. Nets towed on the port side of the *Bulldog* were fishing harder than the starboard net, Rulifson says.

"And that made some difference in our data," he says. "So many things can make a difference."

When the square-mesh net was towed on the starboard side, researchers saw a 25 to 85 percent reduction in bycatch. "But when the net was towed on the port side, there was no significant difference. Because the port side net was fishing harder on the bottom, we still feel the square-mesh FSD was working well," Rulifson says.

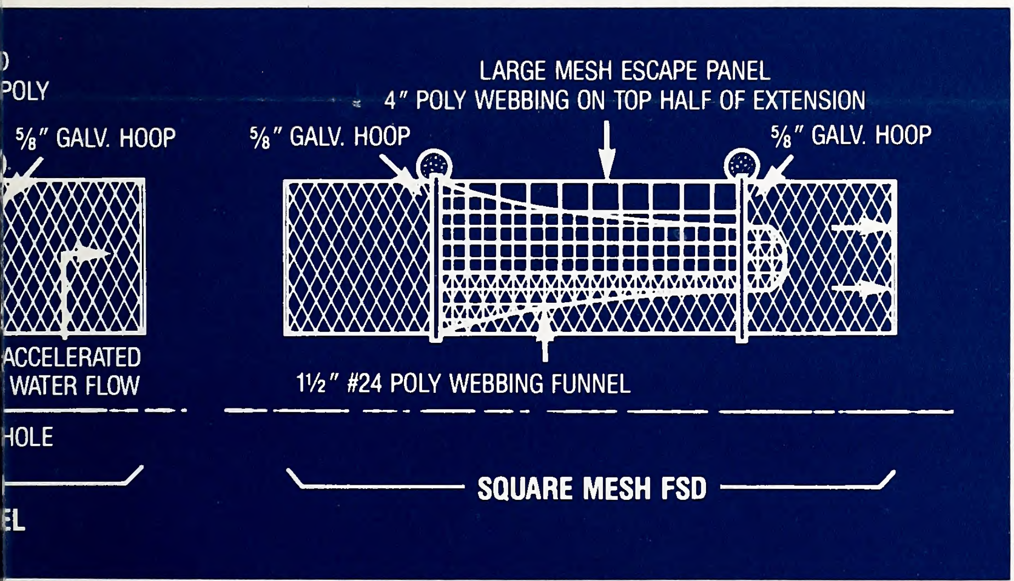
When the diamond-mesh separator was rigged on the starboard side, researchers saw a 37 to 51 percent reduction in total biomass, with no significant loss of shrimp. In subsequent tows, a metal hoop, attached at the opening of the accelerator, was removed. The hoopless net did not reduce bycatch when used on both the port and starboard sides of the boat.

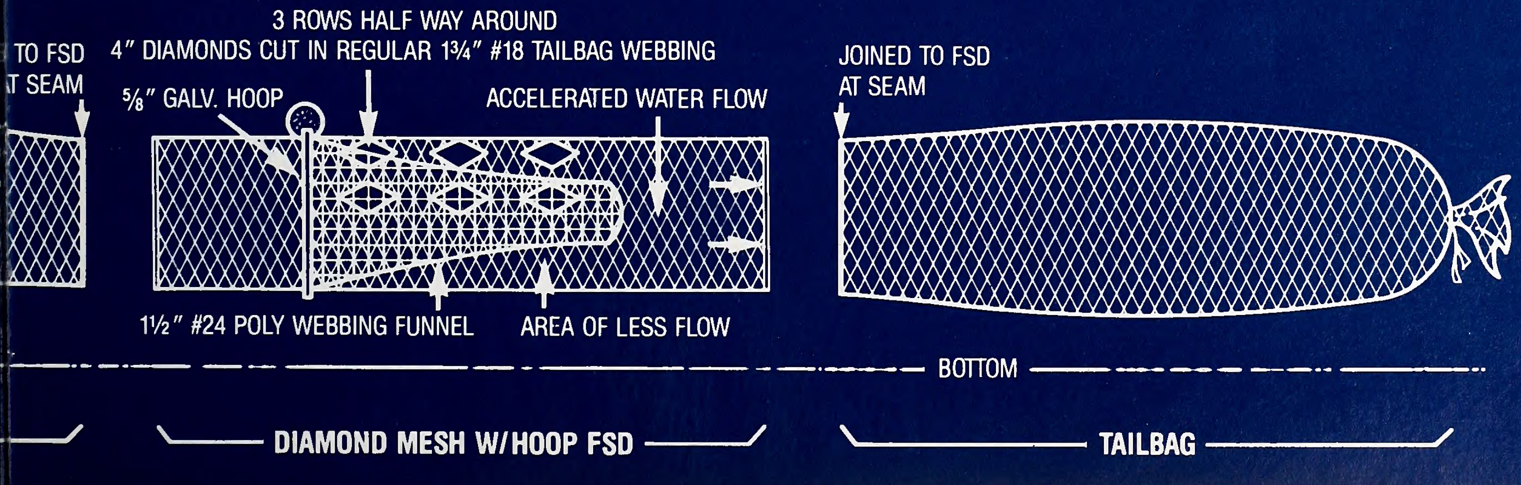
"This tells us that the diamond-mesh separator worked well, but only when the hoop was left sewn in," Rulifson says.

When a modified diamond-mesh separator was used with a TED, bycatch was reduced 35 to 65 percent. "But shrimp loss was anywhere from nine to 55 percent," Rulifson says. "This is unacceptable.

"I should stress that these are preliminary results, that these numbers come from the first week of two weeks of testing," he says. "We were working the bugs out of our gear and modifying it as we went along."

But Bahen says the team was looking at more than just a reduction in





bycatch poundage. "We were also trying to see which kinds of fish were staying in the nets," he says. "And the size of the fish was important too. We not only saw a reduction in biomass, but the smaller fish were finding their way out of the nets."

That's good news, says netmaker Parrish. "We want to be able to keep the marketable fish and let the smaller ones out," he says. "Sure, we could make the holes (in the separator) bigger and let out most of the fish, but that's not what we're trying to do."

The challenge, Parrish says, is to adapt the principles used in the FSDs to nets that must include TEDs. "The smaller fishermen, the ones who tow for shorter periods of time, will use these FSD designs," he says. "Now, we need to make it work for fishermen who are doing longer tows and who must use TEDs."

Bahen says another week of testing during the fall shrimping season should give researchers a better handle on the new FSD designs.

Until then, the data collected from the June field tests will be analyzed more closely.

"I don't know if FSDs will ever become part of the commercial fishing industry," Bahen says. "But when and if it does, we'll have the information fishermen will need to effectively run these nets. Right now, we're getting ahead of the game."

Steve Parrish makes repairs to a model FSD at the David Taylor Research Center.

Photo by C.R. Edgerton

Bycatch Catching Lots of Attention

BY C. R. EDGERTON

Governmental agencies on the state and national levels are planning bycatch strategies. These efforts could make the reduction of bycatch the most talked about fisheries issue since turtles.

The National Marine Fisheries Service, the federal agency charged with regulating the country's fishing waters, is proposing an innovative plan for dealing with bycatch. A steering committee, made up of representatives from government, industry and academia, is in the works.

"NMFS officials say this committee will attempt to look at the overall bycatch picture, and not just innovations in gear," says Sea Grant's Marine Advisory Service Director Jim Murray.

The steering committee will set up a subcommittee that will monitor technical innovations and ideas dealing with bycatch, Murray says.

"In addition to our own work with finfish separator devices (FSDs), there's work being done in Florida, some in Georgia and other places," he says. "Up to this point, there hasn't been a good system to get all this together. That's what the National Marine Fisheries Service wants to do."

The steering committee will also attempt to organize a conference that will feature bycatch-reducing gear from around the world. "This will show that bycatch is not just an American problem, that other countries have been dealing with it for years." Murray says.

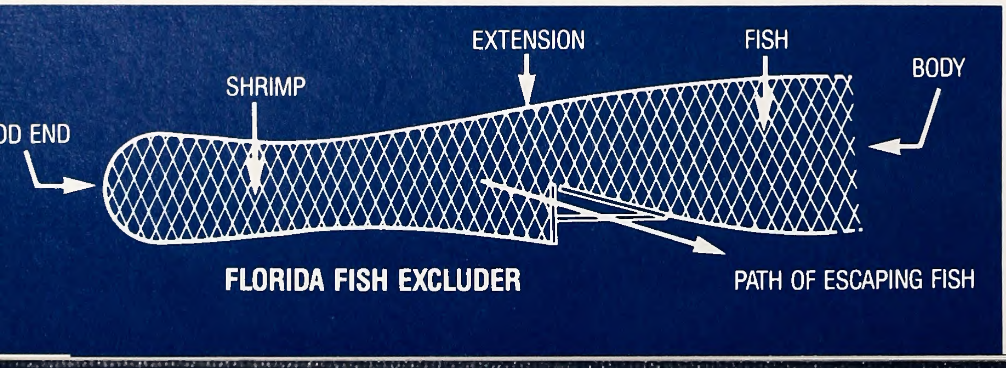
On the state level, the N.C. Division of Marine Fisheries is testing experimental bycatch-reducing gear, including a new net addition known as the Florida Fish Excluder. This device uses a simple bar grid sewn into the bottom of a standard shrimp trawl to allow an escape path for finfish.

"We've been able to see about 30 percent reduction in bycatch using the Florida separator," says DMF fisheries expert Katy West. "On the other hand, we've not had much success with skylight designs." (Skylight designs incorporate larger-sized mesh or holes in the top of the net.)

One major holdback in DMF's efforts to test bycatch-reducing gear is a lack of funding. "Our project has been approved, but the funds haven't come in yet. So we're doing some testing on our own," West says.

DMF's experiments have focused on the inshore shrimp trawl fishery and the offshore flynet fishery. They will also test FSDs in trawls equipped with Parrish, Morrison and Anthony Weedless TEDs.

"The division's position is that we really don't know how much of a problem bycatch really is," West says. "But we know it definitely wouldn't hurt to try to reduce it. We don't advocate a ban on trawling, but we do support modifications in gear to try to reduce bycatch."



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Is it worth 39 seconds of your day to save the life of an endangered sea turtle or a wood duck?

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Join thousands of others across the state on Sept. 22 in cleaning North Carolina's beaches, lakes and rivers.

From 9 a.m. to 1 p.m., volunteers will pick up trash and record what's collected on data cards. The tallies will be used in compiling national statistics on waterway litter.

Taking that time to volunteer means a lot to wildlife who are in a tug of war with floating waterway debris and litter along the shore.

The cleanup also puts trash—and the sources of it—in the spotlight. It's a real exercise in public education. Last year, volunteers collected 81.5 tons of cans, plastic, paper, glass and other trash at 96 coastal and inland sites.

Choose a waterway location near your home or make plans to collect trash at your favorite beach. Wherever you choose to go, you'll help beautify our waters and save wildlife.

A hat, gloves, sunscreen and a good attitude are all you need to bring. We'll supply trash bags and data cards.

Volunteer today to be a Big Sweeper. It's good clean fun.

For cleanup locations, call the Telecom USA Big Sweep hotline between 8 a.m. and 5 p.m. The number is 1-800-27-SWEEP.

Or call Sea Grant at 919/737-2454 for the name and number of the regional coordinator in your area.

Big Sweep '90 is coordinated by UNC Sea Grant, N.C. Division of Coastal Management, N.C. Division of Water Resources, N.C. Division of Parks and Recreation, N.C. Aquariums, N.C. Wildlife Resources Commission, N.C. 4-H Program, Keep North Carolina Clean and Beautiful, Keep America Beautiful, Duke Power Co., Western North Carolina Development Association, WRAL-TV in Raleigh and WGHPiedmont in Greensboro.

Volunteers in North Carolina are making sweeping statements with colorful Big Sweep '90 T-shirts.

The design shows hands pitching in to sweep our shores free of litter. The white, all-cotton T-shirt is washed in warm, Southeast shades of rose, gold and teal.

T-shirt sales support the Big Sweep.

Show your support for Big Sweep and get an eye-catching bargain in return. Shirts are $8 and are available in small, medium, large and extra-large.

To order, send $8 plus $1 for postage and handling per shirt to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605. Postage and handling will be waived on orders of more than 10 shirts.

For more information, call Sea Grant at 919/737-2454.

Add a little marine science to your high school class. Send for Sea Grant's latest marine education curriculum guide, *S.E.A. Lab: Science Experiments and Activities for High School Students in Chemistry, Biology and Physics.*

The 208-page illustrated book is chock full of marine experiments and activities high school teachers can use in the classroom.

S.E.A. Lab is divided into three sections—chemistry, biology and physics. And within each section, activities are grouped around central themes.

For example, four activities in the chemistry section focus on density dynamics in the estuary. In the biology section, one group of lessons features experiments on animal adaptations in the ocean. And in physics, students can learn more about light in the sea.

The activities were developed by teachers and marine science graduate students.

The project was coordinated and field tested by Lundie Spence, Sea Grant's marine education specialist; Dirk Frankenberg of UNC's Marine Science Curriculum; and Jo Wallace, formerly with the UNC Center for Math and Science Education. And it was funded by The Dreyfus Foundation, UNC Sea Grant, the UNC Center for Marine and Science Education, and the UNC Marine Science Curriculum.

The book is illustrated with line drawings that are suitable for photocopying. And an answer key is provided for all activity questions.

If you would like to add a little marine flavor to your lesson plans, write Sea Grant for a copy of *S.E.A. Lab.* Ask for UNC-SG-90-01. It costs $10 plus $2 for postage and handling.

One day a year is not enough time to deal with shoreline litter.

The Big Sweep is producing its first educational publication, *Ripples*, which is aimed at children ages 9 to 11.

The illustrated booklet of 16 activities focuses on the problems created by litter in our ocean and inland waterways. It includes puzzles on paper and active games for groups.

For example, "Be A Sport, Trash Sort" is an active relay that teaches children how to sort recyclables.

"Wildlife Tug of War" teaches children the dangers posed to animals when they become entangled in six-pack rings.

If you're a teacher or the leader of a scout, 4-H or church group and would like to use the booklet, let us know.

Write to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605, and ask for UNC-SG-90-02.

Printing of the Big Sweep educational book was funded through the N.C. Wildlife Resources Commission and the N.C. Wildlife Federation. Copies are free. But please enclose $1 per booklet for postage and handling.

It's 5 o'clock.

You're leaving the beach.

Do you know where your trash is?

Have you left picnic debris, old foam coolers, broken toys and cigarette butts scattered on the shore around you? Then consider this.

Your litter can supply many a fast-food meal for hungry seabirds. They often mistake floating plastic and other trash for dead fish or fish eggs. They swoop down in a feeding frenzy and often swallow before they taste. Then it's too late.

Ingested plastic may block digestion. Or if enough plastic is eaten, the bird may eventually die of malnutrition. The plastic takes up room in the stomach and tricks the bird into thinking it's full. Sometimes it just stops eating altogether.

More than 14 billion pounds of litter accumulates in the ocean each year. Don't make more trouble for wildlife by leaving your trash on the beach or tossing it overboard!

Volunteer for Big Sweep '90

Fill out the form below, and return it to the Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695.

Name______________________________

Address ______________________________

City, State, Zip ______________________________

Telephone number ______________________________

Area you want to clean______________________________

Number of people in your group ______________________________

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Coastwatch

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Coastwatch

UNC SEA GRANT ▪ OCTOBER 1990

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Big Sweep '90

◆

160 Tons of Trash

◆

Photo by C.R. Edgerton

Volunteers Pick Up Everything

Tar Heel citizens made a Big Sweep across North Carolina. They turned out in record numbers Sept. 22 from the mountains to the coast to pick up litter from the state's beaches, lakes, rivers and streams.

Armed with garbage bags donated by GLAD and data cards to record their trashy finds, more than 9,000 North Carolinians bagged 160 tons of trash along Tar Heel shorelines.

Approximately 160 sites across the state were designated for pickup during The Big Sweep '90, the nation's largest statewide waterway cleanup.

Big Sweep '90 was the most successful cleanup in the history of the event, which began in 1987. The 1990 litter totals were double the amount of trash collected in 1989. And volunteers almost tripled. In 1989, 3,600 volunteers bagged 81.5 tons of debris.

Volunteer turnout for this year's 1990 pickup was heaviest along the beaches and in the Triangle and Charlotte areas. Along the Tar Heel coast, 6,600 volunteers collected 81.5 tons of debris—half of the state debris tonnage.

Showers in the mountains and northern Piedmont put a damper on the cleanup in those areas, reducing volunteers and the amount of litter collected.

In their efforts to tidy up our shorelines, volunteers bagged everything from cigarette butts to the kitchen sink.

Unusual finds included an inflatable woman, a two-ton truck, a 1947 Orange Crush bottle, a boarding pass from a Pakistan airlines, an unopened bottle of pickled pig brains, a band leader's hat, a disassembled houseboat and a pay phone.

And although it's these bizarre finds that capture initial attention, it's the more mundane trash that keeps Big Sweep organizers planning cleanups.

Again, plastic and plastic foam items—beverage containers, jugs, lids, cups, cartons—were prevalent at all sites.

Along the beaches, volunteers and site coordinators reported finding abandoned beach chairs, discarded crab traps, lumber, metal and lots of cigarette butts.

Emerald Isle site coordinator Jean Zappia says her volunteers amassed more than 10,000 cigarette butts. That's more butts than were collected for the entire state during the 1989 Big Sweep. At Lake Wheeler in Raleigh, another 3,953 butts were reported.

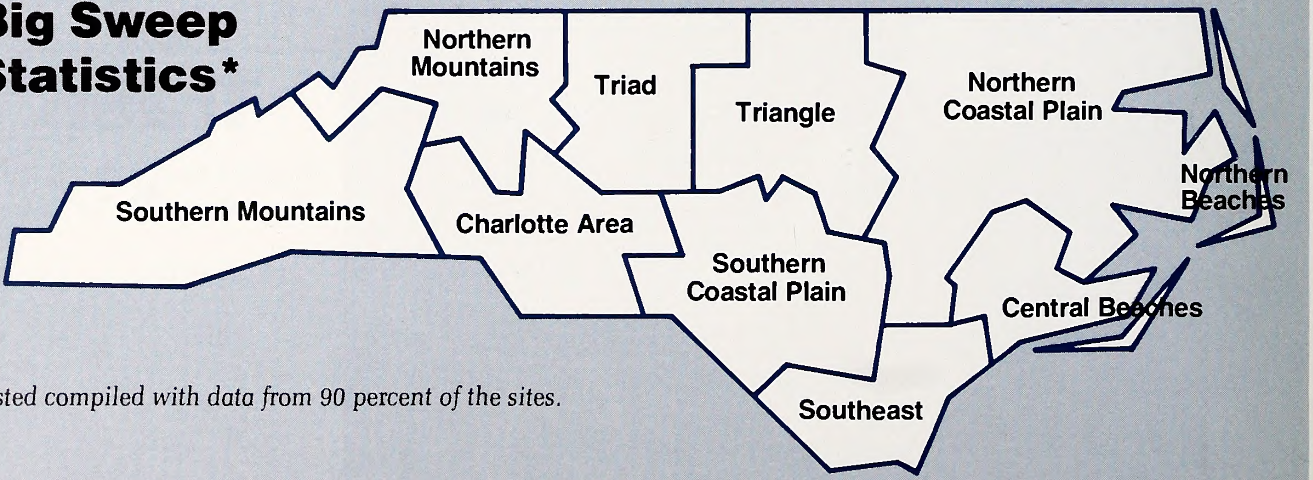
Cigarette butts, or filters, were a new item listed on this year's data cards. Although many people consider the paper-covered filters biodegradable, they are not. Most are made of a synthetic material called cellulose acetate.

Hundreds of deflated balloons scattered the beach at the Pea Island Wildlife Refuge on Hatteras Island. Site coordinator Bonnie Strawser said she was surprised by the number collected. One couple picked up 92 balloons in a short stretch of beach.

At Radio Island near Morehead City, Bruce Naegelen's volunteers sacked bag after bag of military debris—cans of MRE's (meals ready to eat), flares and other items.

But no matter what kind of debris they confronted, volunteers were

Big Sweep Statistics*



*Listed compiled with data from 90 percent of the sites.

Northern Beaches	3,514 volunteers	50.4 tons
Central Beaches	616	18.6
Southeast	1,870	18.0
Southern Coastal Plain	97	1.3
Northern Coastal Plain	401	5.7
Triangle	1,168	17.6
Triad	283	8.0
Charlotte Area	930	25.8
Northern Mountains	115	2.6
Southern Mountains	264	10.8

(Including the Kitchen Sink)

By Kathy Hart

dedicated to the cause.

Ed Brooks, site coordinator at Wrightsville Beach, said one group of high school volunteers spent more than an hour digging out an enormous sheet of plastic that had blown off a nearby construction project.

At inland Big Sweep cleanup zones, citizens heaved satellite dishes, stoves, refrigerators, sofas, chairs and car parts from muddy creek beds and lake shores.

Troop after troop of Boy Scouts, Girl Scouts and Brownies flocked to shorelines to pick up debris. Members from church groups, 4-H clubs, environmental alliances, school classes and college organizations deposited can after bottle after plastic bag after cigarette butt into their bags.

"It was gratifying to see the number of people who came to The Big Sweep and to see their dedication to the cause," says Lundie Spence, Sea Grant's marine education specialist and the coordinator for The Big Sweep.

"We feel like we're building a base of awareness about litter, especially among young people," she says. "And we hope this awareness eventually translates to less litter in our waterways."

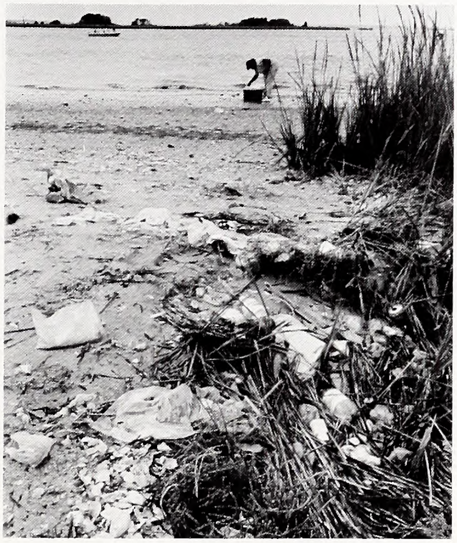


Photo by C.R. Edgerton

In some cases, Big Sweep has already made a difference. Officials from coastal beach communities have installed more beach trash cans and often send out municipal cleaning crews.

Some coastal site coordinators are actually beginning to see a decrease in the litter amassed during The Big Sweep.

But that's not the case inland.

At lakes Jordan, Norman, Wylie, Hickory, James and High Rock, debris—bait containers, beer cans, soft drink bottles and plastic foam pieces—is often as much a part of the scenery as the oaks, pines and maples.

The natural currents of the Cape Fear, Tar, Dan, Uwharrie and Neuse rivers leave deposits of filthy debris in the curvature of their banks.

Boating access sites on these waterways are treated as giant trash cans.

"We definitely have our work cut out for us inland," Spence says. "We need to mount an educational campaign among boaters and recreational fishermen. And we need to find a way to get trash receptacles placed at access points."

Only a few days after Big Sweep '90's completion, Spence and the coordinating committee are already planning for 1991.

The date will be Sept. 21.

Be there. ■

Big Sweep '90 Organizers

UNC Sea Grant
Keep America Beautiful
N.C. Division of Water Resources
N.C. Division of Coastal Management
N.C. Wildlife Resources Commission
N.C. Division of Parks and Recreation
Keep North Carolina Clean and Beautiful
N.C. 4-H
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Duke Power
Western North Carolina Development Association
WGHPiedmont in the Triad
WRAL in Raleigh
WSOC in Charlotte
WLOS in Asheville
WWAY in Wilmington
WCTI in New Bern

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Takeda Chemical Products
Fiddler's Gallery and Framing
House of Raeford, Inc.
D-G Enterprises
Wake Soil and Water Conservation District

A Special Thanks to These Coordinators for Making The Big Sweep '90 a Success:

Rex Peters
Nancy Cowal
Diane Warrender
Nancy Pritchett
Jan Manning
Caroline Parker
Anne Morriss
Lois Nixon
Kay Rogers
Linda Ritter
Lynne Leonard
Lucinda Trew
Pat Brinkley
Sarah Humphries

Cape Fear Trek Yields Boatloads of Garbage

By Carla B. Burgess

Three fishermen sit along the banks of the Cape Fear River, watching their lines and, every now and then, casting a glance at the commotion on the water.

Six canoes glide over the glassy surface of the river just outside of Fayetteville, darting in and out of the arches of draping willow oak branches along the shore. Small motor boats hum along the river too, making frequent stops on the bank near the fishermen.

Cathy and Bill Merritt motor to the shore with their first haul of the morning. Four large trash bags yield the catch of the day—bottles, cans, bait cups, a pair of pants, a tire and rim, a shoe, plastic bags.

They anchor the front of the skiff in the wet sand, and I help Cathy add the bags to the pile on the shore.

Photo by Carla B. Burgess

"Catch anything?" Bill hollers to the fishermen on the bank.

One of the men nods his head left and right.

Bill motions with his head toward the pile of bags. "You see all this trash we've been picking up. You're not going to leave any of yours behind, are you?"

"Naw," the fisherman says, as we push off.

Off and on all morning we motor up the river until we see a trashy stretch of bank that is accessible. Then we get out and search for debris. We find it along the water's edge, nestled in the ground cover, wedged in fallen trees and even hidden under blankets of poison ivy.

"This is disgusting," Cathy says, wondering what impact it would have if we dumped the debris into the offenders' kitchens.

Bill and Cathy are perturbed that Big Sweep doesn't entice people who need its educational message most.

"The ones that throw this stuff down aren't the ones out here picking it up today," Bill says.

Bill and Cathy say they heard about Big Sweep on the radio, then called Anne Morriss, the coordinator for the region and also for this site cleanup. They live on the river a few miles away and use it for boating and skiing.

The Merritts are among 20 volunteers who came this morning to the boating access area on N.C. 87 south of Fayetteville. By early afternoon, they will have cleaned nearly 4 miles of the Cape Fear River, which feeds into the Atlantic Ocean below Wilmington.

Photo by C.R. Edgerton

"I think fishermen are the worst offenders," says Mike Hillenbrand, a motorboat volunteer. "I've seen a lot of bait cans and cups."

A canoe volunteer, Candace Curry, is surprised by all the containers of chicken livers apparently left by fishermen who use them for bait.

"You'd think they're the naturalists," she says.

The canoes stay downriver during the cleanup, and the powerboats go the other way, checking back with the paddlers often to relieve them of any full trash bags. By the end of the cleanup, the group has netted more than a half-ton of debris from the river.

Many things impress me about my first Big Sweep, including the attitude of the volunteers. Most of the people don't know each other, yet they are friendly and cooperative.

In their pursuit of trash—things that are often wet, filthy and heavy—they are determined and ambitious. Volunteers pull tires and even a TV set from the water. Cathy Merritt wrestles with a hollowed-out appliance filled with mud.

Even after everything I have heard about Big Sweep finds, I am unprepared for the grossness of it all. Especially the coils of steel belts and charred patches of ground we find all along the banks—the remains of mounds of tires that have been burned there.

Even leader Anne Morriss, who heads Cumberland Urban Recycling and Beautification, is unprepared for what volunteers find on the banks of the Cape Fear.

It's nearing the end of the cleanup, and the motorboats and canoes congregate around a steep bank littered with a water heater, a bathtub and a bicycle. Some people around me suggest we might be able to haul some of the junk back.

But when volunteer Ron Potter follows the trail of debris up the more than 50-foot bank, he finds a dump site laden with household and electrical waste, appliances and furniture. Another dump site is a few yards away.

Potter opens a bag from a recent deposit of household garbage searching for an address.

"I think a lot of it was what I had expected to find," says Morriss. "But I don't think I expected to find an illegal dump today."

Morriss says she will report the dumps to the county health department.

Photo by C.R. Edgerton

Through cleanups such as The Big Sweep and by regular monitoring of the water in the Cape Fear, people are able to be watchdogs for the environment, says Bill Merritt, who recently applied to join the state's Streamwatch program.

Merritt says volunteers affiliated with the program blew the whistle last year on a local feed company that was dumping raw sewage and chicken parts into the river.

Photographs of the dump site are taken, and the group prepares to head upriver. Now horsepower takes over and the paddlers get a chance to rest. The powerboaters throw out their towlines and the canoeists take hold.

Back at the landing, the volunteers get out data cards and tally the trash collected. There are some 30 bags in the piles and a mound of tires and rims.

"That was just a dent, but I guess you've got to start somewhere," says Bill Merritt. ■

Big Sweep Leader Wants to Change Attitudes

By C.R. Edgerton

She woke up September 22 with trash on her mind.

It was 6 a.m.

As Big Sweep regional coordinator Diane Warrender sipped on her first cup of coffee, she thought of her 20 cleanup sites in the Carteret County area.

In her mind, she traced the day's planned agenda:

- Stop at McDonald's to pick up donated orange drink for volunteers.
- Drive to Pivers Island to put up Big Sweep signs.
- Meet Ranger Mike Rickart at the Fort Macon State Park cleanup site.
- Drive to the landing to check on the 90 or more folks who were shoving off to clean up Cape Lookout and Shackleford Banks.

Then she stopped. An hour and a half had passed since she'd first opened her eyes. There was no time left to daydream. The day would work itself out.

Barring bad weather, Big Sweep '90 would be a success. Months of planning would pay off in one four-hour stretch. Hundreds of volunteers would clean as much of North Carolina's central beaches as possible.

Diane Warrender was ready to hit the road running.

Warrender hasn't always been an environmentalist.

Until about four years ago, the Salisbury native lived like the majority of Americans. She didn't think twice about what happened to her trash once it left her home, car or boat.

Continued

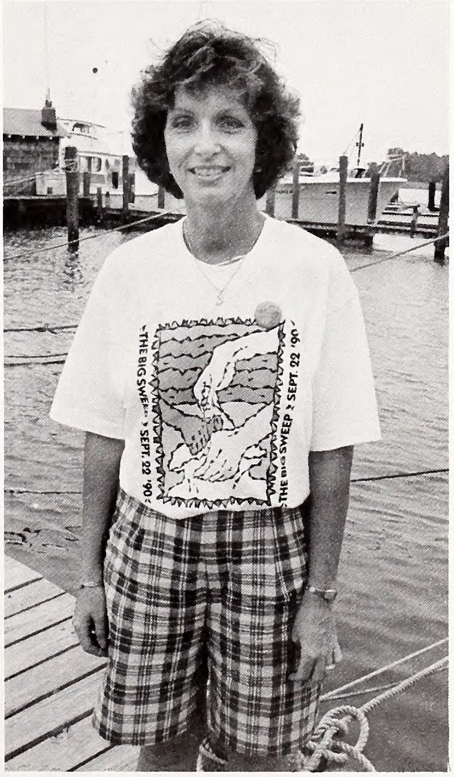

Photo by C.R. Edgerton

Photo by Kathy Hart

She was concerned about clean water and air, but she had not translated that concern into action.

Before she was named Keep America Beautiful coordinator for Carteret County, she had what she calls "inklings of experience" with water quality problems as secretary of a homeowners association.

"And my husband and I had always been boat owners," she says. "We had been sailing in Hudson Bay and dodging all the debris in the water there. That was background."

Then she landed the KAB job in 1986.

"As time went by and as I was exposed to more pollution problems, especially marine pollution, my awareness was heightened," she says.

"I began to feel our own program here in Carteret County could make a difference. I saw no government agencies doing anything to deal with these problems, so we met the challenge."

Now, she says she has become "a bit obsessed." "I eat, sleep and work the whole concept of a cleaner marine environment," she says.

Warrender was one of Big Sweep's original coordinators in 1987, when the cleanup was confined to the beaches and was called Beach Sweep. She entered the Beach Sweep arena skeptical about how much difference a handful of people picking litter from the beaches could make.

"That first Beach Sweep we picked up bags and bags of trash," she says. "They were lining the beach. Back then there weren't many garbage cans on the beach and not much awareness on the part of the municipalities."

Beach Sweep changed all that forever, she says.

"The towns didn't like all the bad publicity they were receiving about the trash on their beaches. So, the next year, they had town workers pick up trash the day before Beach Sweep '88. Now, they have placed more garbage cans on the beaches and they pick up the trash on a regular basis."

That change in attitude is what Big Sweep is all about, Warrender says. The metamorphosis extends not only to town officials, but to recreational fishermen and others who contribute much of the litter that washes ashore.

Her challenge now, she says, is to involve more local people in the annual waterway cleanup.

"The first two years, I was discouraged at the number of local people participating," she says. "We had more people from other areas coming in."

Then, in 1989, the first year of Big Sweep's statewide effort, Hurricane Hugo's winds and rains came ashore and kept potential Big Sweepers indoors.

"This year I've seen a real change in local attitudes," she says. "Earth Day helped here and opened up a lot of doors for us to visit local schools."

Warrender steps out of her station wagon at a Big Sweep site and witnesses the fruit of her school visitations. She meets a busload of 47 middle school students from Havelock and about 50 students from West Carteret High School. All have come to pick up litter.

"This year there have been more young people," she says. "There are large numbers of groups, such as Brownies and Girl Scouts, church groups, clubs, that kind of thing."

Those young people are more than just litter grabbers. They are the key to a brighter future for the marine environment, Warrender says.

"Since the whole focus of Big Sweep is changing attitudes, what better people to start with than the youth," she says. "They begin to think about the trash they generate and their responsibilities for doing something about it.

"They won't be thought of as environmentalists," she says, "because taking responsibility will be a natural part of their lives, like brushing their teeth. Everyone will be doing it.

"And, in 20 years, we're all going to be more intimately involved with our garbage, whether we like it or not."

She gets back into her car and drives in the direction of the Grayden Paul Bridge at Beaufort, where another cleanup crew has gathered to meet the challenges of Big Sweep '90. ■

Photo by C.R. Edgerton

The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

Fish farming is alive and well in North Carolina. And there are plenty of aquaculture experts who want to share their know-how with you.

They'll get their chance at the third annual N.C. Aquaculture Development Conference, scheduled for October 30-31 at North Carolina State University in Raleigh.

The conference will feature an impressive slate of experts including Sea Grant's Associate Director Ron Hodson, who will speak on the culture of hybrid striped bass. Sea Grant Marine Advisory Service agents Skip Kemp and Wayne Wescott will talk about clam nurseries and crab shedding, respectively.

Participants in the two-day conference will hear the latest research on pond culture systems, aquaculture in existing farm ponds, raceway and tank systems, and estuarine aquaculture.

A technology session will introduce participants to recirculating systems, biological filtration technology, and aeration and oxygen injection systems. Discussions will center on problems in production with recirculating systems.

The conference will end with a tour of "the fish barn," a new aquaculture demonstration and research facility at the university. An organizational meeting of the N.C. Aquaculture Association will be held after lunch on the second day of the conference.

Registration for the conference is $45 ($55 after October 25). This includes handout material, lunch, tours, break refreshments and the Aqua-Food Festival, featuring heavy hors d'oeuvres made from Tar Heel aquaculture products.

For registration information, contact Debra Williams at 919/338-6200.

If you missed the wave of aquatic fashion that swept through North Carolina during the statewide shoreline cleanup, you didn't miss the boat.

Big Sweep '90 T-shirts are still available with a price tag that's hard to beat. You'll never be out of style in the colorful all-cotton T-shirt with the Big Sweep logo.

Regional coordinator Diane Warrender is pictured sporting hers in this issue. Take a look!

To order, send $6 per shirt to UNC Sea Grant, Box 8605, NCSU, Raleigh, NC 27695. Please specify size (S,M,L,XL) and quantity. Make checks payable to The Big Sweep.

Make an environmental statement and help a worthy cause; order a Big Sweep T-shirt today while quantities last.

Fishermen in South America are taking some tips from the Turks on who to consult about crabs.

A group of 15 fishermen and management representatives visited Sea Grant Marine Advisory Service agent Wayne Wescott in October for a lesson on crabbing and trawl fisheries.

"They're very interested in our blue crab fishery because they're thinking about starting a fishery themselves," Wescott says. "This might even result in some consulting from Sea Grant to South America."

Wescott is not a stranger to these out-of-country experiences.

In January 1988, he traveled to Turkey to give advice on developing a soft crab shedding industry on the Mediterranean Sea.

South America has a red crab that is larger than our blue crab, Wescott says. The fishermen there are also interested in our trawl fishery.

Wescott says the meeting was "an effort to bring them up to date on the technologies in North Carolina."

As cold snaps clear the air in autumn, the bluefish begin their fall "run," or migration. And when the blues are running, recreational anglers line Outer Banks beaches like gulls on a pier.

Fishermen land "tailor blues," or snappers, which may weigh only a few pounds. Or occasionally they haul in big "whopper choppers." They can tip the scales at almost 20 pounds.

Whatever the size, bluefish are voracious feeders. They whip through schools of small baitfish, leaving a trail of blood, gore and fish parts for swooping sea gulls to devour.

The diving gulls trace the path of the blues for fishermen anxious to cast a line. And anglers are almost always rewarded when they heave their lures and hooks amidst the feeding frenzy. Even unbaited hooks will score hits.

Catching blues is the easy part. Knowing when to stop depends on how much you like the fish and how quickly you can eat what you keep.

Bluefish, like other predacious fish, have powerful digestive enzymes that cause the flesh to spoil quickly. If bluefish are not gutted or iced quickly, they can acquire a fishy taste and mushy texture.

Joyce Taylor, Sea Grant's seafood education specialist, makes these recommendations.

- Keep only what you plan to eat within a few days. Release the others.
- Gut and ice bluefish immediately. Keep the fish iced as you transport it home.
- If you plan to freeze any of the fillets, Taylor recommends glazing—a technique of coating the fish with a gelatin-and-lemon mix. For a copy of the glazing instructions, send for a copy of *Bringing the Catch Home.* Ask for UNC-SG-86-26. The cost is 50 cents.
- If you do freeze your catch, be sure to label your package with the date. Bluefish do not have a long storage life and you should plan to eat the frozen fillets within a few weeks.

- Because bluefish are an oily fish, frying and broiling are two of the best methods of preparation. Or try smoking your catch. Cold, smoked bluefish, smeared with sour cream, dill and lemon dressing, rivals the salmon in taste and presentation.

Congratulations are in order for three Sea Grant employees who have been recognized for excellence in their fields.

Rich Novak, Sea Grant's marine recreation specialist, recently received the Chancellor's Award for Outstanding Extension Programming from NCSU Chancellor Larry Monteith.

Novak works in Manteo and assists state and local government officials in the difficult task of planning for tourism and other recreational activities. Sea Grant staff members have won the Chancellor's Award six out of the last seven years.

Marine education specialist Lundie Spence was featured as Tar Heel of the Week in the September 23 issue of *The News and Observer* in Raleigh. "This is a significant recognition of her years of unselfish commitment to The Big Sweep and marine science education," says Marine Advisory Service Director Jim Murray.

Murray himself was recognized recently when he was named to a national Sea Grant committee charged with developing a "think piece" on how the Marine Advisory Service should look by the year 2000.

Health officials have known for a long time that North Carolina's coastal and inland soils aren't always ideally suited for conventional septic tank systems.

That's where UNC Sea Grant's publication *Design and Installation of Low-Pressure Pipe Waste Treatment Systems* can help.

The manual, written by soil scientists from NCSU, points out construction procedures and materials needed for a low-pressure pipe waste treatment system.

The book focuses on the best locations for LPP systems and provides detailed instructions on installation and maintenance.

Although LPP networks may work for larger buildings, the systems described in the manual are best suited for homes and small businesses.

For your copy of *Design and Installation of Low-Pressure Pipe Waste Treatment Systems*, send $2.50 to UNC Sea Grant. Ask for publication UNC-SG-82-03.

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Photo by C.R. Edgerton

Currituck: On The Wings Of History

Waterlily. Corolla. Coinjock. Grandy. Held together by a saltless sound, these towns and others make up the County of Currituck. It's a county most unusual, where you can fish for freshwater bass while the ocean roars in your ears; where an old decoy sells easier than waterfront property; where a flat beach serves as the only link between beach communities.

The next two issues of Coastwatch *will focus on this unique coastal county. In the first issue, we'll look back at Currituck's rich heritage. In January, we'll examine the forces—natural and man-made—that are shaping the county's future.*

Looking Back at the Land

When land-buying sprees started in the late 1800s, Currituck residents often found themselves living on someone else's property.

"Hunt clubs owned most of this beach for years," says Shirley Austin of Corolla. "Sometimes some of the people actually lived on hunt club property," she says. "They might own their house but not the land it sat on."

Most of the time, the hunt clubs didn't mind, she says. The homeowners were not troublesome. Some clubowners asked for token rental fees.

Austin, whose father worked for the Coast Guard, says her family owned their house just above the state line in Virginia. They paid $1 annual rent to the landowner.

The people of Currituck know what it is to go around their elbows to get to their thumbs.

They boat across the sound to avoid long drives. They use the beach as a road to reach their homes. And they wait patiently to take state ferries across the sound.

They've been doing it since their ancestors crossed the swamp and marshland on a corduroy road made of logs.

Before then, American Indians were said to have crossed the shallow sound on beds of oyster shells.

But whatever the obstacles, people managed. They farmed the land, fished the sound, hunted the abundant waterfowl and thrived as best they could in this sprawling county.

From the Virginia state line, the county stretches south in three fingers bordered by the Atlantic Ocean, the Currituck and Albemarle sounds and the North River.

Many communities can be reached only by a boat, a ferry or a very long drive.

Even by water, you have to know how to "drive" in the shallow sound. Boaters must carefully navigate the myriad shoals in Currituck Sound, which is nearly 30 miles long and 3 miles wide.

You can easily find yourself in 2 feet of water out in the middle.

The sound and its distinctive qualities set the area apart from other coastal habitats. Where else can you fish for largemouth bass and hear the roar of the ocean less than a mile away?

The sound is almost all fresh water, and hasn't been linked directly to the ocean since New Currituck Inlet shoaled in 1828. The subsequent flourishing of freshwater vegetation such as widgeongrass and wild celery became a prime attraction for waterfowl. The proliferation of ducks, geese and swans, along with an abundance of fish, sustained the residents of Currituck County.

In the late 1800s, wealthy Northerners flocked to Currituck, buying large tracts of land on the banks and islands in the marsh. There, they established opulent hunt clubs that provided work for many natives.

"These were poor people," says Warren Austin of Barco, who has been a hunting and fishing guide for 30 years. "The sportsman came down and he had money. They tipped pretty good and you had a good Christmas."

Before "market" hunting was outlawed in 1918, many Currituck residents killed waterfowl by the thousands for sale to northern markets. They packed the birds in barrels around ice-filled cylinders.

On the beaches, bankers worked for the Coast Guard, lighthouse service or lifesaving stations.

Small northern banks settlements such as Wash Woods, Seagull and Poyner Hill sprung up where coastal jobs were available. All except Corolla have virtually disappeared.

Early lifesavers on the Outer Banks received little compensation for their long hours of work. A keeper could earn an annual salary of $200, a crewman $40 a month. And some paid dearly for their work.

The entire crew of Jones Hill Station died trying to save the crew of an Italian vessel wrecked at Currituck Beach in 1876.

Other jobs arose when construction began in 1874 on the last major lighthouse on the Outer Banks. Currituck Beach Lighthouse, a red brick structure 150 feet tall, was lighted in December 1875.

"My grandfather originally came here from Hatteras in the late 1800s to this lighthouse," says Gene Austin, whose recent retirement as keeper closed the book on three generations of Austins caring for the Currituck light.

For Austin's grandfather, Riley, tending the lighthouse was a full-time job, and he lived in the keeper's house. For Gene, it was a weekly task. He checked on the

Waterlily, N.C.

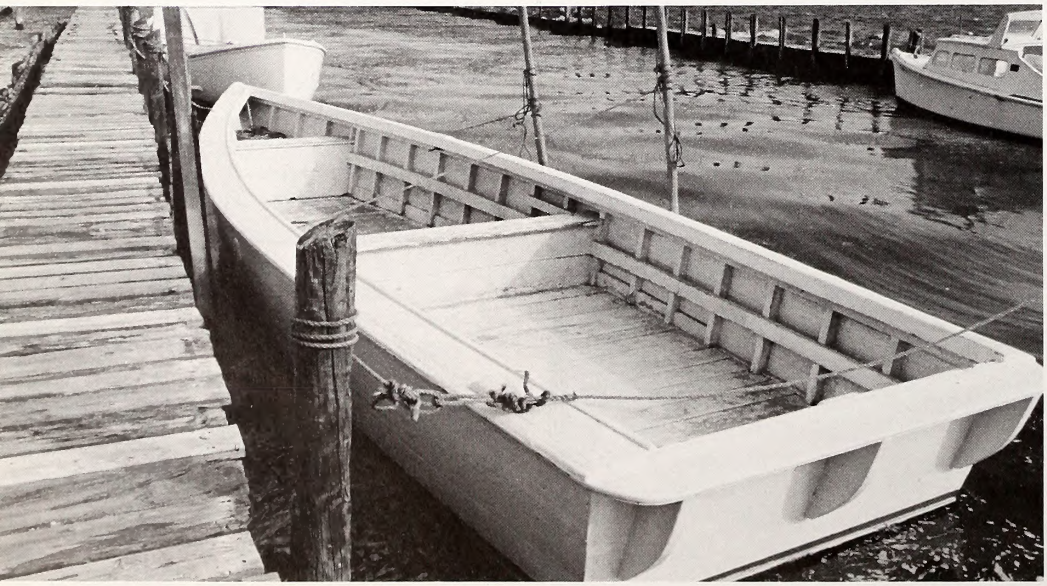

Photo by C.R. Edgerton

# of Fish and Fowl

By Carla B. Burgess

lighthouse and made sure the lens was clean, the generator was running and the batteries were charged.

In the 1920s, many Currituck residents left the county. But they returned during the Depression because they could live off the land and the sound, says Norris Austin, Corolla postmaster.

Ralph Barco, 80, who lives in Grandy on the mainland, says the folks of Currituck County were resourceful when it came to making a living. Barco worked as a hunting guide, ran a lodge and sold produce to the Dare County tourist traffic. Now he deals in real estate and septic tanks.

"My father was the first in Currituck County to shed crabs," he says.

On a warm October day, Barco drives his truck through his undeveloped Sound Side Estates, stopping at the water's edge.

"That's Barco landing," he says, pointing to the place where his family's fish house once stood.

During the market hunting days, his grandfather would buy ducks and geese from hunters at the landing and then ship them north for sale. Live carp were bought and sent to New Jersey. Live crabs were placed in special trays packed with grass for shipment to New York and Baltimore.

Barco said they even loaded oyster boats with watermelons in summer.

And in freezing weather, the Barcos scraped ice from the docks and stored it in a building with sawdust to use in spring shipping.

In warm months, the water doubled as a source of recreation. Residents swam and fished throughout the county.

In Coinjock, situated on the Albemarle and Chesapeake Canal, residents saved their money all summer to see "Adams Floating Theatre" in the fall. The showboat floated through for the first time in 1917 "with flags flying and the band playing," one historical account states. It continued its visits through 1930.

In Poplar Branch, residents sought a lively evening at the floating tavern.

Currituck has grown up since the days of shell roads and buoyant entertainment.

The area is developing rapidly and changes are coming too fast for lifelong residents like Shirley Austin of Corolla.

"You'd better not leave for too long," she says. "Or you won't be able to find your way back." ●

Historically, the church was the social center of rural communities. Currituck County is no exception.

"My mother was born north of Corolla, a place called Seagull," says native Shirley Austin. "They had things called box suppers at the church, where the girls all prepared a picnic in a box."

The boys would bid on the girls' boxes, and the husbands on their wives.' "The bidding got kind of heavy sometimes with the singles," she says.

A church was built at Waterlily, also called Church's Island, around the turn of the century. The chapel was to be nondenominational, but restricted to Protestants.

"They had what was called a circuit rider, which was a minister that traveled around. I remember when one of them preached there at Waterlily," Austin says, explaining people went to other churches also, depending on how they liked the preacher. "The congregation would slack off sometimes. It was an up and down kind of thing."

Taking Aim at Waterfowl

By Carla B. Burgess

Sam the swan looks secure in his place among the mallards this sunny autumn morning. He stands as stiff as a decoy, his head raised proudly as if he knows he's being watched.

In another place and time, the watcher might have been looking down the barrel of a shotgun. But today Ralph Barco, 70, is just gazing out the window of his truck, admiring the view of the pond.

"I talk to 'em all the time, tell 'em how pretty they are," says the Grandy resident. "To me, today the pleasure of looking at the birds is more than shooting them."

A lot of older generation Currituck hunters have adopted this attitude. Maybe it's age. Or perhaps it's respect for a declining resource. It's not that they've stopped hunting altogether. They've just mellowed.

Barco, like many of his fellow natives, has had an ongoing love affair with the waterfowl that flock to Currituck County. He's hunted them, guided others in the hunt and, until recently, ran a lodge in his home for visiting sportsmen.

The birds have long been a golden egg to the area, its economy and its heritage.

The waters of Currituck Sound and surrounding marshlands were once one of North America's premier wintering grounds for snow geese, canvasbacks and whistling swans. When the birds flew south, the hunters flocked behind.

Drive down almost any street or back road in Currituck County and you'll see them—duck lawn ornaments, geese whirligigs, birds painted on mailboxes. Their likenesses show up on signs for motels, realtors, restaurants and resorts.

Dig beneath this decor and you'll find the once thriving artery that kept the heart of Currituck pumping. Almost everyone there is connected to the hunt in some way.

The men—and some women—toted their shotguns to the marsh from childhood.

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Ralph Barco

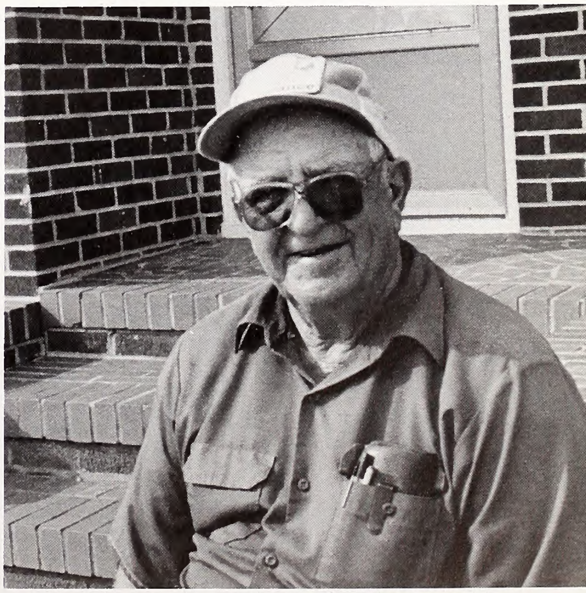

Photo by Carla B. Burgess

Hunting clubs were the pinnacle of exclusivity. The posh clubhouses and the prime marshland surrounding them were a literal playground for the very rich.

In the early 1900s, initiation into the Swan Island Club cost a hunter $5,000. Members couldn't sell their hunting rights. Only the existing members could choose a replacement for the one who withdrew or died.

As the story goes, one publishing and railroad mogul made his own rules. The Lighthouse Club and its membership barred his wife, an avid hunter, from the grounds. So he bought the club property and built his own manor there.

E.C. Knight's Whalehead clubhouse, completed in 1925 at a cost of $383,000, had a copper roof, cork floors, corduroy-covered walls, Tiffany lamps, a 16-room basement, five chimneys and an elevator.

Families hunted to put food on their tables. Sons, fathers and grandfathers worked as guides. Men and women worked in lodges and hunt clubs as caretakers and cooks. Inn owners rented rooms to visiting sportsmen.

And before the sale of waterfowl was outlawed in 1918, "market" hunting kept locals busy supplying a tide of trade to the north.

In the late 1800s, a hunter might get as little as a quarter to as much as a dollar for a pair of ducks, depending on the species. A pair of geese might bring 50 cents. After the turn of the century, hunters could expect $2 to $7 a pair for birds.

Even when prices were low, hunters could at least be assured of an endless supply of game.

In addition to live and artificial decoys, hunters used corn to lure birds into shooting range. In some areas, wide-barreled "punt" guns, spewing a pound of shot at once, could bring down a raft of waterfowl. Hunters Russell and Van Buren Griggs reportedly killed a record 892 ducks in one day on Currituck Sound.

"I've heard Van Buren Griggs went out one day with a case of 500 shells and came home with more than 500 ducks," says Barco.

In daylight, hunters often hid themselves below water level in battery rigs or sink boxes. Ducks were also taken at night, herded against the shore and then immobilized by a lantern's blinding light.

At times, hunters fired their guns so frequently they had to dip the barrels in the sound to cool the metal. Otherwise the guns were too hot to handle.

Market hunting was a business, and as author Neal Conoley pointed out, these gunners were harvesting "what they considered a boundless renewable natural resource."

Currituck residents also catered to out-of-towners who came to the area to hunt for sport.

"Pampered" is the word Ralph Barco used to describe guests at his lodge, which he ran nearly 30 years. At his table, lodgers feasted on roast beef, fish, coleslaw, apples and other country delicacies. On the sound, they were accommodated in "the Barco Hilton," a box blind 16 feet long with a hinged board bunk and a commode seat on a box.

Guides would take hunters to the blinds, assemble the stand of decoys, watch for birds, tell them when to shoot, pick up the kill and ferry the hunters back to the lodge.

At Swan Island Club, guests wouldn't even dress for the hunt each morning until a guide had warmed their rooms with a fire.

A guide had a great responsibility—to look out for the safety of the hunter as well as himself. Barco still remembers the powder burn left on his hat when a hunter nearly shot his head off in a blind.

Guide William Wright says he once picked up a fellow at the crack of dawn who had already been hitting the bottle.

"He was full," says Wright, who has been a guide for 50 years. "I put him out in the blind and he slept all day."

Waterfowl hunting has changed since the days a cloud of birds on takeoff would block out the sun. Destruction of habitat and breeding grounds and other man-made problems have taken their toll on the bird populations.

People here say the decline of grasses in the sound has left the birds with too little food.

"I went out recently with a hunter," says Wright of a particularly beautiful day on the sound. "We saw two deer, two coons and a white heron. The man with me said he didn't care whether we shot a duck or not." ●

Whalehead Club

Photo by C.R. Edgerton

Decoys Preserve Hunting Heritage

By C.R. Edgerton

When it comes to old-time Currituck decoys, Jarvis Snow is no quack.

He lifts a weathered duck from the shelf in his smokehouse, carefully avoiding the fragile neck.

This one is longer, more streamlined than most of the ducks and geese. Its rough finish and plain markings are a dead giveaway.

"This one was carved by Ned Burgess, probably in the late 20s," he says. "It's worth about a thousand dollars."

He rubs the duck's back and lays it in its slot on the shelf among the dozens of dusty, worn waterfowl he's collected over the years.

Some folks call Jarvis Snow a showman, like his wife Erlene, who, before her death in April, was a national champion goose caller.

Snow comes about his knowledge of decoys honestly enough. His father, Dexter Snow, was for many years superintendent of the famous Whalehead Hunting Club across Currituck Sound at Corolla. Dexter Snow's carved duck and canvas-covered geese are prized among collectors.

"This one here, the head on it was carved while my daddy was sitting in a duck blind out in the sound, waiting for something to shoot at," Snow says, pointing to a handsome, canvas-covered Canada goose still dressed in its original paint. "I know because I was sitting right next to him when he was doing it."

He shows off some of the other decoys in his collection and points to the photograph on the cover of a book. It's a stubby ruddy duck carved by Alvirah Wright decades ago.

"One like this recently sold for more than $27,000," he says. "I sold this same duck about 10 years ago for $45."

If Jarvis Snow isn't a fixture in Currituck County, his home certainly is. A visitor who hasn't been to the county in years still remembers the canary-yellow siding, the manicured lawn and the outbuildings lined up like ducklings.

On the lawn, a plank about two or three feet long and six inches wide announces the owner's passion: "Decoys."

The home is a monument to the history of Currituck's glory days, when decoys were produced by the thousands and hunters came from all over the world to bag the ducks, geese and other waterfowl that stopped there during their winter migrations.

Jarvis Snow

Photo by C.R. Edgerton

In a corner of the living room, Dexter Snow's carving tools rest in their original pine toolbox. Another corner is filled with plaques, posters and ribbons attesting Erlene Snow's prowess as a goose caller.

But the primary objects are the decoys. Jarvis Snow buys them, sells them, trades them and talks about them.

An oak pie safe is filled with decoys, all factory-made in Virginia.

"Some people might not think these ducks are worth much on the market," he says. "But they're worth a lot to me."

He picks one up and turns it over. The bottom is branded with the name E.C. Knight.

"That was the man who built the Whalehead Club," Snow says. "I keep these decoys because they remind me of the days I was a guide there with my daddy. They're priceless to me."

Snow recalls watching his father make decoys by the hundreds for his stand on Currituck Sound. Most of the solid wood ducks and geese were made of juniper, another name for white cedar. This species is resistant to water damage and unsavory to insects that damage other woods.

The wooden decoys produced in eastern North Carolina are distinctive for their crude form, inexpensive construction and simple colorings. These primitive qualities make them collectible as folk art.

Old-time Currituck carvers whittled the bodies and heads of their decoys from separate pieces of wood and connected the two with nails or with mortise joints. Weights were attached to the bottoms for stability and then a coat of paint was applied. Some carvers painted more detail than others. Most decoys were used for work, so they were plainly adorned.

The canvas-covered geese, made exclusively by decoy-makers in North Carolina and southeastern Virginia, were built of pillow-tick canvas stretched over a frame of juniper and stiff wire. Heads were carved separately and were attached by screws or nails.

Because they were constructed of inexpensive materials by craftsmen who could make them quickly and cheaply, working decoys were often mishandled in the field. With constant use, their heads would

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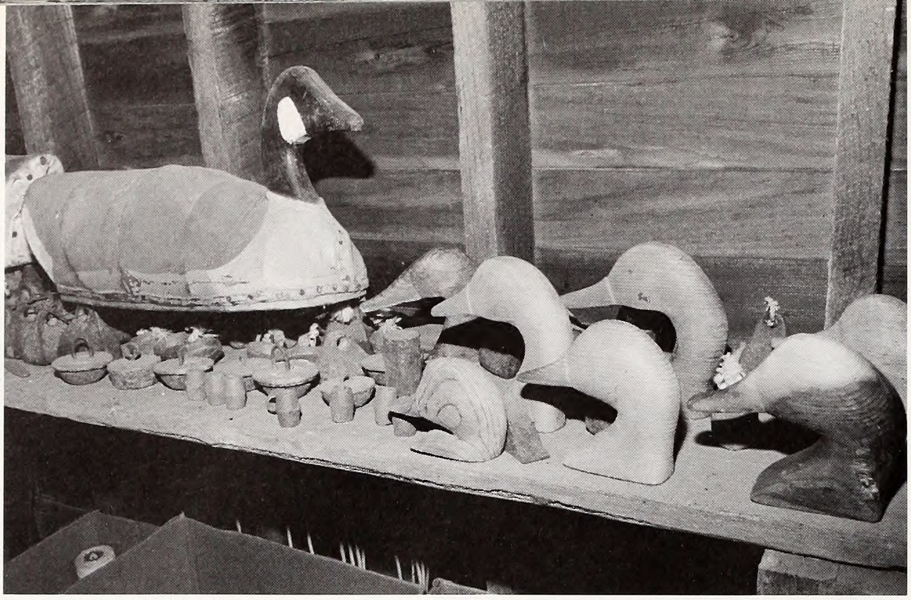

Photo by C.R. Edgerton

ultimately break off.

"That's why it's not unusual to see a decoy with a head made by one person and body made by another," Snow says. Only the shrewdest collectors can name both carvers by looking at the decoy.

Snow remembers that his father would carry as many as 400 decoys on a single hunting trip. Boxer Jack Dempsey was among the celebrities guided by the Snows, as were a host of generals, admirals and politicians.

The waters of Currituck Sound are shallow, but the lure of its old-time decoys still runs deep in the hearts of those who want to see these relics of the past preserved.

"They're pretty much a part of our heritage here," says Currituck native Sharon Meade, a member of the Currituck County Wildlife Guild. "People depended on these decoys for their livelihoods. But they never would have guessed that the things they made for fifty cents apiece would be worth so much today."

Meade takes a duck from the shelves of the old Snowden General Store in Currituck. She points out its weaknesses, its strengths, its primitive artistry. Some of the ducks are hers, others belong to Guild members. One day, she says, all of them will be on permanent display in the much-talked-about Currituck Wildlife Museum.

"Decoys have come a long way in the last few years," she says. "It was nothing, when I was a child, to see old folks chunking them into the woodstove. I cringe when I think about it now."

The cringing is justified, she says, when you consider that brand new carved and painted decoys can bring as much as $90. The older ones then, are worth several times that.

"And a lot of our stuff, our decoys, are being bought up and are leaving this area," says Wilson Snowden, a former county commissioner who chairs the Currituck Wildlife Museum's Board of Directors. "We're trying to preserve and save our heritage, and it's getting expensive to do that."

Snowden says many of the Currituck decoys that end up in private collections are purchased from dealers who operate in areas far from the freshwater shores of Currituck.

"They're buying North Carolina stuff from other states and bringing it back here. We want to make sure the decoys stay here where they were made in the first place."

To meet that goal, Snowden's group recently purchased the decoy collection of William Neal Conoley Jr., executive director of the North Carolina Aquarium Society. The collection, which is documented in Conoley's book, *Waterfowl Heritage, North Carolina Decoys and Gunning Lore,* is valued at about half a million dollars, Snowden says.

"It's worth that much not only because the decoys are valuable," Snowden says. "But because he's taken the time to document all his decoys. That makes a difference."

Another big difference in Conoley's collection is its variety. Nearly all the major North Carolina carvers—and some whose names are lost to history—are represented.

But half a million dollars?

"Like Sharon said, it's part of our heritage," Snowden says. "The people here in Currituck County lived off the land. They farmed, fished and timbered. The decoys are a symbol of all that.

"Besides, it's something not a lot of other areas have. The canvas decoys are a good example of this. They were made for a purpose, and each one is unique. Each one is a piece of folk art."

"And the whole folk art thing is what's made them more valuable," says Conoley. "Folk art can be defined as something that is made for a utilitarian purpose, but also exhibits a particular style and grace, a special skill and workmanship not found in other ordinary objects."

Conoley says the top six Tar Heel decoy carvers—Alvirah Wright, Ned Burgess, John Williams, Mitchell Fulcher and Lem and Lee Dudley—all exhibited that style that makes their decoys works of art.

"Before they died, these men may have made only 20 decoys or they may have made 200," Conoley says. "But each one they carved shows that style and grace that can only come from that individual. That's what makes North Carolina decoys different from any others in the country." ●

Sharon Meade

Photo by C.R. Edgerton

The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

Don't worry about wading through the malls of madness this holiday season.

From Sea Grant's mail-order bookstore, you can shop in the comfort of your own armchair.

Try browsing in the serenity of the nature aisle. *A Guide to Ocean Dune Plants Common to North Carolina* (206 pp.; $4.50) describes and illustrates the herbs, vines, grasses, shrubs and trees found on and near the dunes of the Tar Heel state. For the collectors on your gift list, consider *Sea Shells Common to North Carolina* (38 pp.; $2). Gardeners might enjoy a copy of *Seacoast Plants of the Carolinas for Conservation and Beautification* (206 pp.; $4.50). This handbook details the use of plants for landscaping and stabilizing coastal soils.

Sea Grant's education section offers some playful selections for kids. *Coastal Capers: A Marine Education Primer* (80 pp.; $3.50) introduces and explains the marine environment to primary grade children. It's filled with lively illustrations and activities. *Ripples: A Big Sweep Elementary Activity Guide* (40 pp.; Free, $1 postage) contains activities on litter in our coastal and inland waterways and is tailored for the 9- to 11-year-old. It contains games and puzzles.

Browse through the cooking section. Seafood education specialist Joyce Taylor's *No-Salt Seafood* (36 pp.; $3.50) is a hot item on our culinary shelves. It features a host of wholesome mouth-watering ways to cook fish and shellfish seasoned with herbs and spices. It's perfect for preparing festive, yet healthy, holiday meals.

Another favorite, *Recipes With A New Catch* (40 pp.; $2) is filled with delicious recipes for cooking 16 species of non-traditional fish—shark, triggerfish, bluefish, amberjack and more.

For those friends handy with tools, consider a gift from our "how-to" section. *A Guide to Recreational Shrimping* (34 pp.; $4) provides detailed instructions for rigging small boats to catch shrimp. *How to Build a Crab Pot* (14 pp.; $1.50) is a handy step-by-step guide for putting together a sturdy crab catcher. *A Guide to Soft Shell Crabbing* (32 pp.; $3) instructs laymen on how to shed and harvest blue crabs.

This is only a fraction of the literature available through Sea Grant's mail-order bookshop. To find out about other publications, call the Sea Grant office at 919/737-2454.

To order, send a check or money order for the amount specified. The address is UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

Season's Greetings!

A coastal landmark at Lake Mattamuskeet is getting some much-needed help.

A private organization, Friends of Mattamuskeet Lodge, has been formed to raise money for the restoration of the 77-year-old pumping station and hunting lodge on the lake's eastern shore. A photo of the building was featured in the June-July issue of *Coastwatch.*

Don Temple, manager of the Lake Mattamuskeet Wildlife Refuge, says about $100,000 will be needed to get the old building suitable for occupation. Another $1.5 million will be needed for complete restoration, he says.

The building, known primarily for its lighthouse-like observation tower, was built in 1913 as a pumping station for a company that wanted to drain the lake and use its bottom as farmland.

In the 1930s, after the company failed, the lake bed was sold to the federal government and the pumping station was converted into a hunting lodge. When hunting declined in the 1970s, the lodge was closed and hasn't been occupied since.

For information about the restoration project, contact Temple at Lake Mattamuskeet National Wildlife Refuge, Route 1, Swan Quarter, N.C. 27885, or call 919/926-4021.

Who knows where North Carolina's coastal waterbirds go when they get the nesting urge?

James Parnell and Mark Shields do.

The two Wilmington ornithologists recently completed a 20-year study of the traditional nesting sites of herons, gulls, terns and other colonial waterbirds in North Carolina.

The result of that study is a new Sea Grant publication, *Management of North Carolina's Colonial Waterbirds.* The book, designed as a companion volume to Parnell's two-volume *Atlas of North Carolina Colonial Waterbirds,* lists every nesting site found from Currituck to Shallotte. Also listed are geographical features of the sites and a history of its use as a nesting habitat. A series of maps pinpoints exact nesting locations.

The book is expected to become a standard tool for use by scientists and others charged with managing waterbird habitats.

For a copy of the book, send $5 to Sea Grant. Ask for publication number UNC-SG-90-03.

North Carolina's coastal counties are bursting at the seams.

People from all over America are pouring into our seaside cities and towns. In fact, four of the state's five fastest growing counties are on the coast.

But with the people come problems.

How can public officials best manage a growing population's use of the public waterways?

There are some answers.

Many of them can be found in a new publication sponsored by the Albemarle-Pamlico Estuarine Study, *A Pilot Study for Managing Multiple Use In The State's Public Trust Waters.* Walter F. Clark, Sea Grant's coastal law specialist, is the project's principal investigator.

Clark and a team of demographic consultants focused their study on Carteret County, whose waters are some of the most used in the state.

The new publication highlights their conclusions and suggests new policies that will assist city and county planners and managers in developing local ordinances governing the use of public trust waters.

The policies, if adopted, would affect fishermen, marina operators, developers and recreational users of the waterways. The outcome, Clark says, would be better managed and more environmentally sound waters.

Copies of the report will be sent to planners and managers in all North Carolina coastal counties and will be available for public inspection at the Albemarle-Pamlico Estuarine Study office in the Cooper Building on McDowell Street in Raleigh. The telephone number is 919/733-0314.

What happens when you combine coastal North Carolina and good homestyle cooking?

You get a copy of *Coastal Carolina Cooking*.

Written by *Coastwatch* editor Kathy Hart and former staff writer Nancy Davis, this cookbook offers more than 150 recipes for the kind of coastal fare folks dish up in their homes in Maple, Hatteras, Gloucester, Sneads Ferry and Winnabow.

Published by the University of North Carolina Press, the cookbook includes time-honored recipes from 34 coastal cooks.

In Edenton, Frances Inglis shares her recipe for plum pudding from the pages of a nineteenth-century family cookbook.

Flonnie Hood of Burgaw provides a family corn bread recipe that will set your mouth watering and your stomach rumbling.

And for seafood cooked the coastal way, try Mitchell Morris' oyster fritters, Bill Pigott's conch chowder and Glennie Willis' deviled crab casserole.

But the cooks provide more than just recipes. They recount the heritage of the coast through stories, anecdotes, helpful tips and historical fact. Vignettes on each cook lend a historical perspective to this book, and the old-time recipes will be treasured for years to come.

Receiving a copy of *Coastal Carolina Cooking* is like getting a taste of home. Give it as a gift this holiday season or add it to your own cookbook collection.

For a copy, call the UNC Press toll-free number 1/800/848-6224. The cost is $9.95 plus sales tax (if you are a North Carolina resident), shipping and handling. They do accept VISA and MasterCard. Be sure to provide your street address for UPS delivery.

Or check with your local bookstore.

***Coastwatch* is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.**

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